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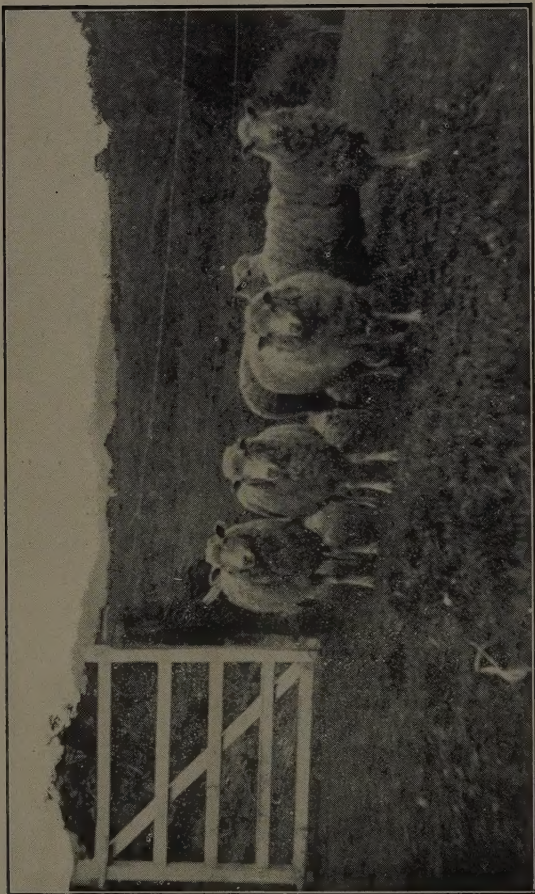
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TYPES OF FIJIAN SHEEP.

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FIRST QUARTER, 1929.

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EDITORIAL.

STAFF CHANGES.

Several changes have taken place in the Staff of the Department since the end of the year.

The Superintendent of Agriculture, Dr. J. D. Tothill, has been promoted to be Director of Agriculture, Uganda.

Mr. W. G. Bennett, B.V.Sc., Government Veterinary Officer, has resigned to take up a position under the South Australian Government.

Miss E. McKearn, Stenographer, has resigned and returned to Australia.

The Assistant Superintendent of Agriculture and Inspector of Produce, Mr. J. Kermack, will act as Superintendent of Agriculture.

Mr. G. A. Wishart will act as Inspector of Produce.

Mr. E. J. Hart has been temporarily transferred from the Treasury to the clerical staff of the Department.

Mr. N. G. J. McNally has been appointed Third Class Clerk.

The Government Entomologist, Mr. H. W. Simmonds has taken over the Editorship of this Journal.

THE SHEEP INDUSTRY IN FIJI.

PAST HISTORY AND RECOMMENDATIONS FOR FUTURE DEVELOPMENT.

By CHAS. R. TURBET, B.V.Sc., Senior Government Veterinary Officer.

INTRODUCTION.

EARLY Fijian literature contains many references to sheep and the subject seems still to be a favourite one. Most of the writers stated that these animals did well, whilst more recent authors give opinions as to why these optimistic forecasts have not been fulfilled. Their general opinion, however, seems to be, that, within certain limits, sheep might be successfully reared in this country, returning a profit to the breeders.

An attempt has been made by the writer to collect as much information as possible concerning these early efforts and place it in proper sequence, so that a study might be made of the factors which have retarded the development of this industry in Fiji, a country which has always been considered suitable for the purpose.

In addition to early references in literature, the author has drawn largely from the experiences of practical breeders in the Colony, supplemented by his own observations during the past six years, as Government Veterinary Officer.

EARLY IMPORTATIONS.

The first importations are reputed to have been made by Dr. Brewer, who was in the United States Consular Service in Fiji, from 1860-1876. Several extensive runs were, some few years afterwards, opened up on the northern shores of Vitilevu and Vanualevu, and on Taveuni, by British subjects from Australia and New Zealand. From these early sheep, samples of wool were sent to the London Exhibition in 1862, some at least of which came from Dr. Brewer's flock, which he ran on the island of Wakaya.

About this date a friend of Seemann wrote: "We find sheep answer well, the wool grows rapidly, the sheep fatten well and the ewes breed rapidly, frequently having three lambs at a birth, so that we can, bye and bye, export wool as well as mutton."

In 1864, according to Ricci, upward of 1,000 sheep were safely landed from Australia, making in all a total of 3,000 then in Fiji. Their importation had been a decided success and generally they were doing well. He augured that, as they were being imported by men of capital, it was not improbable that the interest would largely increase in a few years. This early success and optimism caused Seemann to write: "It was formerly supposed that the climate of Fiji was far too warm for sheep, but that does not now seem to be the case."

Mrs. Smythe, about 1864, quotes from a letter from a Fiji resident: "I told you how we indulged in the rare luxury of a leg of mutton on Xmas Day, and rare I may call it as we have not tasted mutton since. Sheep (Sipi) do well in Fiji, but, as yet, only exist in a very small numbers. Since my last letter a small vessel from Melbourne has gone to the Norfolk Islands to fetch a cargo of sheep, so that in time we hope to hear of Fiji as a wool producing country."

Referring to Makogai, Horne stated that "sheep are bred on the island and several good flocks were seen grazing on the hills." Elsewhere he stated that "stock such as sheep and cattle thrive exceedingly well in Fiji."

None of these early writers make mention of any factor which might militate against success. No pessimistic reports seem to have been made, every reference being couched in glowing terms for a bright future for the industry. Yet, we find, in spite of this optimism, a gradual lessening in the numbers present in the Colony, from the time they reached their first peak in 1888, until to-day, except occasional temporary increases due to fresh importations. Early efforts however must have met with considerable success in order to create the optimistic impression for the future which prevailed in those days.

About 1879, Wilkinson imported a small number and ran them at Bua. This flock seems to have been successfully carried on, increasing to 550 by 1901, but rapidly declined within the next few years. In 1909, however, fresh importations by Mr. H. H. Darcy brought it up to 2,000, after which another decline commenced and, when taken over by Messrs. Edwards and Hall, about 1912, it numbered a little over 1,000. In a short time it was further reduced to about 400, and these were, with the exception of a few, sold. The latter are now in the possession of Mr. H. Edwards at Nabouwalu, who maintains their numbers at about 40, some being sold annually to the butcher at Levuka.

The largest individual flock was that of Mr. A. J. Campbell at Tauarau, which in 1888 consisted of 5,758. It showed a steady decline however from that date and seems to have disappeared about 1903.

In 1887 sheep were grazed in the province of Tailevu to the number of 673. A few years later, however, record of these seems to have disappeared. At the same time a flock of equal dimensions was running at Taveuni, which however had dwindled to 70 in 1900.

A handful were grazed in Macuata province from early times up to 1919, but have now gone, as they have from Navua, where a few were formerly kept; presumably for the supply of mutton, in the days when Navua was a sugar growing district.

Rewa and Suva districts have always had their small quota, chiefly for butchering purposes. They were at one time also fairly successfully grazed at Samabula.

The earliest records available to the writer show that Lau has always maintained a small number, but the same feature is revealed, a decline following each increase due to new importations.

Following Campbell's and Wilkinson's ventures, J. Tyler commenced running sheep at Tavua in the nineties. It is the remains of this flock which is still carried on with success by Messrs. Foulis and Marsh, under the management of Mr. G. C. Foulis at Wainivoce.

In 1908, Mr. K. P. Wright started at Nadroga with a flock of 1,436, maintaining that strength for about eight years. Two years later, however, it was less than half; probably due to sudden sales, before disposing of the property.

When Messrs. Bryce and Howard took over Rasikula, about 1918, there were between 500 and 600 present. Since then this flock has diminished, so that to-day it consists of only a small number grazing about the homestead.

The Government Station at Nadarivatu, when Mr. A. A. Wright was District Commissioner, maintained a flock of 20 ewes, with some rams, raising about ten lambs annually. These served to supply the station with mutton; but they too have now gone.

SHEEP RUNS OF THE PRESENT DAY.

Perhaps the most successful flock now in existence is that of Foulis and Marsh. This is still about 500 strong and is conducted with care. The run is properly fenced, and the animals supplied with licks and mustered regularly for classing inspection, shearing and other operations associated with the industry.

The run is typical of the average class of country along the foothills on the northern and western coast of Vitilevu, being undulating and covered with grass and low scrub, intersected by numerous streams edged with small belts of timber.

Mr. Edward's flock at Bua, as previously stated, is maintained at about 40 head, the wool resulting from his annual clip being regularly sold for good prices.

In 1928, Mr. W. E. Duncan imported from Australia two Dorset horned rams and six ewes, two Suffolk rams, with four ewes and twenty-five Corriedales. His intention is to experiment with those breeds on his Mua Estate on Taveuni. These are now the only sheep on Taveuni and their number amounts to about fifty.

Messrs. Morris, Hedstrom, Limited, also realise the great benefit which would accrue to Fiji if the industry could become well established in the Colony. They have commenced breeding with a trial flock of crossbred Leicester ewes with a Leicester ram, on the island of Kanacea, in the Lau portion of the group.

It will thus be seen that whilst the industry in Fiji has fallen to such an ebb that it can hardly be said to exist, most breeders are of the opinion that the country is suitable for the purpose and that the industry could be made a profitable one.

BREEDS TRIED.

The earlier importations by Wilkinson, were, according to Edwards, Border Leicester. They were well framed, strong healthy animals, well filled in the crutch, and of a good mutton type. The wool was light and inclined to felt badly. The importations of twenty years ago which were added to this flock were largely Romney crosses and Lincoln crosses; also a few half-bred Merino ewes and Romney rams, resulting in a considerable mixture of breeds. Edwards states that the Lincolns did not do as well as the others.

At Wainivoce Estate they were originally Merino, but later became crossbred, due to the importation of other breeds to endeavour to establish a more suitable type. When Mr. Foulis took over the property he found that the wool was of poor quality and the sheep of an uneven line. He bred the ewes to Merino rams for about three years, but, finding that he was getting a type too close wooled for the climate, imported coarser wooled Romney rams to offset this characteristic. The flock is now of quite fair quality and a more even line as regards size and staple of wool. His last importations were two Border Leicester rams.

The animals on the Rasikula Estate were apparently of mixed breeds, but showed traces of the Border Leicester, and there was also probably some Corriedale present.

The results of the experiments being conducted by Mr. W. E. Duncan at Mua Estate, with Dorset Horn, Suffolk and Corriedales; and those of Messrs. Morris, Hedstrom, Limited, at Kanacea, with crossbred Leicester ewes and pure Leicester rams should be followed with considerable interest by the agricultural and stock-raising fraternity.

TYPE OF COUNTRY.

The type of country which has been considered most suitable for sheep farming in Fiji is that found bordering the Sigatoka Valley and along the foothills of the Western and Northern coasts of Vitilevu from Nadroga to Ra. A similar class of country occurs from Bua stretching along the Northern coast of Vanualevu. It is mostly open, undulating to hilly. In its virgin state it was covered with a dense growth of tall reed-like grass (*Micanthus japonicus*) from 6 to 20 feet high, which is totally unsuited for sheep grazing. It has, however, in most of the more accessible areas, been killed out by heavy stocking with cattle. When treated in this way it is soon replaced by smaller grasses and shrubs. Patches of timber occur in places, whilst a considerable amount is always to be found along the numerous creeks which intersect the country, every small valley having its running stream. Areas of limestones notably in the Sigatoka Valley also occur and these might be considered the choice sites for sheep farming. The dry zone, in spite of its popular description is, however, subject to a wet season, lasting from December to May; with an average rainfall of about 70 inches.

CARRYING CAPACITY OF AVERAGE LAND.

The carrying capacity of the land is variously estimated. Nowhere, however, provided noxious weeds have not taken possession, is more than one acre per sheep required. If kept clear and improved grasses planted a stocking of three to the acre is not too great. From this it will be seen that a flock, about 1,000 strong, might be carried safely on a well-kept 500 acre run.

FODDER PLANTS AND NOXIOUS WEEDS.

When the reed grass (Nagasau) has been destroyed by burning and overstocking it is soon replaced by other herbage and grasses. Unfortunately, however, noxious weeds also come in. In the dry zone Guava is the chief pest of the hills, while *Solanum torvum* is becoming increasingly so on the flats. There are also two types of burr producing plants.

*Lantana sp.** and *Clidemia hirta*, whilst very common in the wet zone, are not yet plentiful in the dry. Of the grasses causing grass seed infestation *Chrysopogon asiculatus* and *Cenchrus echinatus* are the most troublesome, the former being plentiful.

Among the useful fodder grasses are to be found—

Heteropogon contortus.—This is not palatable to sheep when mature, but the young growth, which comes on after burning and subsequent rain, yields a rich pasturage.

Axonopus compressus, the low-lying carpet grass is a good sheep fodder, but not abundant.

Paspalum conjugatum, the luxuriant Thurston grass of the wet zone does not do so well in the dry areas but is found in shaded spots.

Paspalum orbiculare is plentiful, but only the young growth seems to be relished by sheep.

Rhodes grass, *Chloris gayana* and Natal Redtop, *Tricholæna dregeana* have been introduced and the latter is abundant.

Couch grass, *Cynodon dactylon* is becoming more plentiful.

Paspalum dilatatum is also growing in small areas.

Panicum distachyum, called Thurston grass by Greenwood, is probably one of the most useful grasses of the area and is spreading.

The plant *Sida retusa* furnishes some fodder and the *Desmodiums*: *D. triflorum*, *D. heterophyllum* and *D. heterocarpum* are much favoured as feeds.

These three plants replace the temperate clovers and trefoils, which do not thrive in the tropics—

The sensitive plant, *Mimosa pudica* has not extended widely over the dry zone, but is plentiful in the wet. Once sheep become accustomed to it, it is relished and provides good fodder. When first fed off, however, it is apt to cause a dermatitis, affecting the lips and nostrils. This is apparently due to injury from its thorns, followed by infection.

* See note on page 34 of this issue.

Crowfoot grass, *Eleusine indica*, is plentiful and useful.

Kikuyu grass, *Pennisetum clandestinum* has been introduced and promises well.

Other grasses, too numerous to mention, have also been tried with varied results.

Sufficient experimental work has now been done to show the futility of endeavouring to grow in Fiji the vast majority of those grasses, clovers and other fodder plants of temperate regions which have not already become established. For new grasses it will be wise to look to other tropical countries, whilst much more use might be made of useful varieties already established. The improvement of the pasture should be a never ending task. A labour party, according to the size of the property, should be consistently employed cutting out noxious plants, whilst the spread of those fodder plants which have been found to be most useful should be encouraged by the dissemination of seed and by hand planting.

EARLY METHODS ADOPTED.

Early breeders attempted to apply the system of large runs with only occasional musterings to Fiji, such musterings being far too infrequent for local conditions. Only one or two of these breeders fenced properly and little attention seems to have been given to such matters as dipping, regular drenching and licks. In some cases also the rams were not even segregated, leading to irregular lambing with consequent wastage.

CLIMATE.

The climatic conditions prevailing in Fiji are very mild for a tropical country. The rainfall varies from 60 to 80 inches in the different parts of the dry zone. The highest shade temperature seldom exceeds 95° F. and is generally in the eighties in the summer. In winter, noonday heat is about 75° F. and night 55° F. On the most sultry day animals can remain cool by lying in the shade of trees on hill-tops. The ground soon dries after rain if the sun shines. At times, however, long periods of wet weather set in which are not favourable. The wool becomes saturated, not only by the rain itself, but also by the long grass, which, even in dries weather, is saturated with dew every morning. This continual wetting has a bad effect on its quality. Where trees are not already present it is advisable to plant them, many varieties being suitable, the Mango being particularly so.

Periods of three or four months without rain also occur, during which time the pasture rapidly deteriorates, most Fiji fodder plants being water-loving and non-drought resistant.

LABOUR.

There is ample Fijian and Indian labour available for the small requirements of sheep farming. It has been found that Fijians can learn to use both the blades and the hand machine, but are slow workers. That, however, is not a great disadvantage when dealing with small flocks.

LAMBING.

The percentages of increase have been variously quoted by different sheep farmers as from 25 per cent. to 96 per cent. The lambing percentages from the most successful during the last ten years varying from 86 per cent. to 96 per cent. One breeder gives as the reason for the poor lambing on his property that the ewes were much too fat. Whilst this may be true, the writer is of opinion that other causes were probably more important, such as, running the rams with the ewes all the year round, lack of care of ewes in lamb and at lambing, high mortality of lambs in the first few days of their lives from various preventable causes.

WOOL.

One of the author's correspondents, writing about a recently imported lot, was so elated that he wrote: "The new fleece is of very fine quality and texture and from the rate of growth will no doubt require two shearings per year." That second shearing may or may not be necessary, but the report and results obtained from sales of Fiji wool indicate that the climate of Fiji has little if any deleterious effect on it, and that sheep can at least grow a crop which pays. Mr. G. C. Foulis considers that fine and close wooled varieties are not suitable, owing to the heavy rainfall. With close wooled sheep the fleece never becomes properly dry during the rainy season, the yolk gets washed out and the wool loses its "life." The quality of Mr. Foulis' wool is "fair crossbred." His main object, however, is mutton-producing and he aims to produce only such wool as is consistent with the production of good mutton.

Mr. Edwards, writes, that last year's wool sold on 24th August, 1928, in Sydney, brought 1s. 9½d. per lb, and the wool from his flock has always brought good prices. The fleeces are light, the better ones weighing six pounds only.

The sheep from Sigatoka formerly cut fleeces up to 7½ pounds and when sold in the grease in London brought up to 2s. 3d. per pound.

Fijian wool is apt to contain a large amount of vegetable matter. The seeds do not however penetrate deeply, and the great majority germinate, soften and fall out, due to the moisture and heat of the climate. Indeed, sheep have been noticed with grass growing from the wool. The spinning count of Fiji wool of better quality is 56-60.

MUTTON.

An average of 1,577 live sheep and 700 carcasses are imported annually into Fiji for mutton purposes, most of this is consumed by Europeans. The Indian population of between sixty and seventy thousand are however potential heavy mutton consumers, the majority being of those castes which consider the ox sacred and do not eat beef. They now depend mostly on goats to supply their meat ration, but would prefer mutton to goat meat.

The present price for a two-toothed wether runs from 30s. to 40s. With a larger supply this would naturally fall somewhat, but is largely controlled by the cost of importing, from Australia and New Zealand. The average weight of twelve months old wethers on Wainivoe is 42 pounds. The quality of Fiji mutton is reputed to be equal to that of Australia or New Zealand.

DISEASES.

Reports, and the writer's observations, show that sheep in Fiji are remarkably free from serious diseases. There is no liverfluke, whilst nutritional disease is only evident to a small extent. Intestinal parasites (worms) are, however, probably responsible for far more losses than generally supposed. Sheep farmers state that they sometimes find carcasses dead from no apparent cause, such finding not being sufficiently frequent to cause alarm. Intestinal parasites undoubtedly cause most of these deaths, wormy sheep being noticeable in the paddocks at times. Foot-rot is present, but has been noticed more frequently in goats. Possibly these being more numerous attract more attention; hence the impression that they are more frequently and seriously affected than sheep. Blow-fly trouble has not, as yet, assumed the alarming proportion that it does in Australia. It is not a common custom to leave dead animals unburied, or unburned, as it is in some countries badly affected with these pests.

Cancer of the ear occurs. Edwards writes that "about one per cent. of the sheeps' ears become sore, probably caused by sun and rain. I find the simple cure is to clip the end of the affected ear off and this soon heals." This would be very effective as a cure, but in other countries the operation is illegal, as it destroys the identification ear-mark.

Tetanus is reported to have occurred in the Makogai flock many years ago. There are, however, no recent records of this disease so far as sheep are concerned.

CAUSES CITED FOR THE FAILURE OF SHEEP TO BECOME ESTABLISHED.

It has been stated by one breeder that stealing was the worst evil to be contended with, resulting in his case, in the loss of almost the whole of his flock. Other prominent breeders, however, do not mention this as a difficulty. Mr. Foulis of Wainivoce states that "the greatest menace to the industry is the wild dog pest," and on that account he can only run them in the paddocks surrounding the homestead. If wild dogs were exterminated, he considers sheep-breeding would be an easy and profitable proposition. Mr. Edwards also says: "I am perfectly certain that sheep in Fiji would long ago have been a big industry if it had not been for the wild dog question."

It is also claimed that lack of sufficient capital by early sheep experimenters prevented them making the necessary improvements to their runs in the nature of fences, which are essential for the proper handling of sheep.

OTHER CAUSES NOT CITED.

Worm infestation probably causes a greater loss than is recognised as, where the inspection of flocks and pastures is not carried out regularly, sheep which die are not missed until the counting of the flock at the general muster, whilst the dead carcasses would doubtless be destroyed by wild dogs and pigs and thus escape notice.

Little effort seems to have been made to care for the breeding ewes, which, left to themselves in bad weather and with poor grass, must have suffered heavy mortality.

Where wild pigs are numerous they have been known to kill lambs and even ewes, and though loss from that cause has not been generally recognised as serious, it is believed by the writer to be so.

RECOMMENDATIONS.

The following is not intended as a complete treatise on sheep raising, but rather to point out some of the particular requirements for success in Fiji.

Australian methods are not suitable. Fencing difficulties, rapid growth of noxious weeds and, in some places, difficulty of mustering, render large areas impracticable and any attempt on such lines would lead to lack of control, with ultimate failure.

SELECTION OF SITE.

The writer considers that a unit sheep farm in Fiji should consist of no more than 500 acres, running a maximum of 1,000 head.

In selecting his run the prospective farmer should seek undulating country, showing a tendency to produce good grass. In this respect reed land is generally suitable. He should endeavour to avoid areas where guava or

other noxious weeds are abundant. The land should be well watered, have some patches of timber and be reasonably near to an important centre through which his produce could be sent to market.

FENCING ARRANGEMENT.

The laying out of the fencing plan is of the utmost importance, the management of the flock depending upon the amount of capital available for this purpose. It is desirable that the whole run should be fenced and suitably subdivided, whilst if sufficient capital is available, and the nature of the country lends itself to it, the boundary should be dog-proof. This is not easy, owing to the number of difficult streams, also careless people will leave gates open and this is always difficult to avoid. An alternative method, which has the advantage of being cheaper, is to have a central night paddock, surrounded by a dog-proof fence. This should be sufficiently large to prevent the grass being eaten right out and the place becoming a quagmire in wet weather. Water is not essential in this paddock, and it is preferable not to cross streams, which render it difficult to keep the fence dog-proof. It would then be necessary to corral the sheep each evening within this enclosure. This means a little extra labour, but has the advantage of providing a daily check on numbers and condition. It is also advisable to have a second dog-proof fenced lambing paddock, to avoid the necessity for mustering ewes when heavily in lamb. The rest of the run should be subdivided in a radiating manner from the central night paddock. This plan will enable rotation of pastures to be easily maintained.

Fencing is not as expensive as might be anticipated, as wire, stables, iron and steel standards for this purpose are admitted duty free. Posts, Buabua (*Guetterda speciosa*), Vesi (*Afzelia bijuga*), Kukuluva (*Wormia biflora*) and other suitable woods can generally be cut and delivered along fencing line by natives at a low cost. A very useful growing post can be procured in many places and a plantation of these is easily made and quickly grows to post size.

To construct an efficient vermin-proof fence around the night paddock the posts should be 9 feet apart (586 to the mile) for rigidity, but when these are scarce the distance may be increased to 12 feet apart (or 440 to the mile). They should be two feet into the ground and four feet six inches high. A dog-proof fence need not be specially high. The specification should provide for some form of wire netting; the lower edge sunk into the ground with one barbed wire to prevent pigs rooting under it. If ordinary wire netting is used the top should be braced with a plain wire to prevent slackness. The netting should be surmounted with two or more barbwires set not too far apart, to prevent dogs jumping over. For the boundary and subdivision fences the usual six-wire sheep fence with 440 posts to the mile is satisfactory. This latter costs about £80 per mile. The small vermin-proof fence around the night paddock is naturally of a much more expensive design.

THE SELECTION OF A SUITABLE BREED.

It has not been determined which breed, or combination of breeds, is most suitable for Fijian conditions, but as the production of mutton seems to offer the best prospects, efforts should aim to produce as good a fleece as is consistent with this objective. The climate does not seem to suit the Merino, although on Erromango in the New Hebrides, Mr. H. W. Simmonds was informed that pure Merinos are successfully run, the number in 1924 being estimated at 10,000. The whole of the dry area in Fiji is a very similar type of country to Erromango.

Unless prepared to look beyond Australia or New Zealand the choice of breeds is limited, the easily procured kinds being Merinos, Crossbreds and Corriedales. The Crossbred is usually a cross of Merino with Romney Marsh or Border Leicester rams. Of the English breeds these last-mentioned two are the most easily procurable and this fact alone is a good indication of the high quality of both. Most of the flocks of the past have been crossbreds and I doubt whether any one breed has been tried out on its own merits. The Romney Marsh, on account of its robust constitution, general excellency of body and fair quality wool, is deserving of a trial as a pure breed. It is, however, advisable that the number of breeds imported for trial be limited, otherwise there will be degeneration, owing to too much crossing causing lack of character. Finally, in the selection of the breed only a dual purpose animal should be considered, as the prospects of profit are better for that class than one developed solely either for wool or mutton.

THE MAINTENANCE OF THE HEALTH OF THE FLOCK.

As an aid to the maintenance of health, necessary for development of body and growth of wool, licks containing essential mineral elements should be made available at all times. The requirements differ slightly in different localities. It will, however, be found that these licks not only supply deficiencies in the animals' diet, but also have a beneficial action in controlling intestinal parasites (worms).

The prospective sheep farmer should consult the Veterinary Division of the Agricultural Department as to the most suitable one for his particular requirements.

In order to guard against serious losses from the above-mentioned worm infestation, the flock should be regularly drenched with an approved drench.

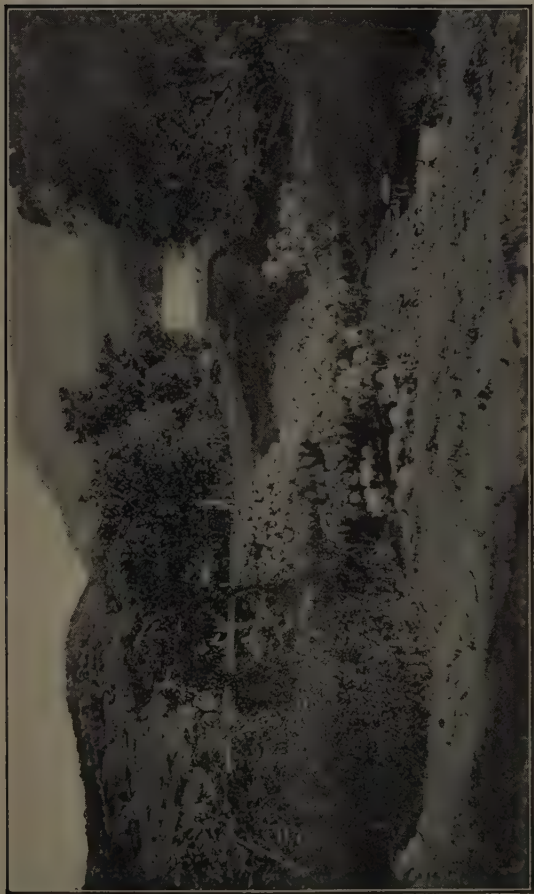
The wild dog pest is most likely to be effectively controlled by a combination of good fencing, conscientious overseeing, and a systematic campaign of poisoning, trapping and shooting. In this control work the Government is co-operating.

Except in these details, sheep husbandry in Fiji will not be found to differ in its methods from those employed elsewhere, particularly in those countries where small flocks of dual purpose animals are the rule.

The writer is indebted to Mr. H. Edwards, of Nabouwalu, Bua; Mr. R. P. Little, of Kanacea; Mr. W. E. Duncan, of Suva; Mr. G. C. Foulis, of Wainivoco, Tavua; and the Veterinary Officers of the Department of Agriculture, for assistance in compiling this paper.

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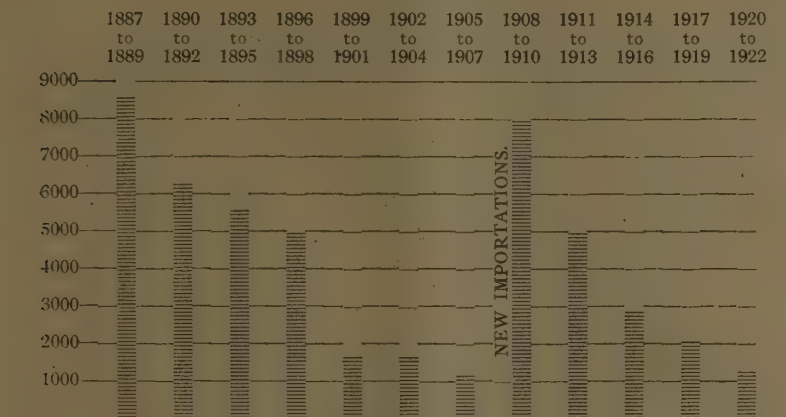


A MOUNTAIN STREAM ON A FIJIAN SHEEP RUN.



MUSTERING IN FIJI, TYPICAL SHEEP COUNTRY.

THE MAXIMUM ANNUAL NUMBERS OF SHEEP IN TRIENNIAL PERIODS FROM 1887 TO 1922.



EXCELSA COFFEE.*

By T. B. McCLELLAND.

THE recent hurricane has greatly accentuated a need already felt by the coffee planter long before the storm—that is, the need for new coffee plantings. Owing to the widespread damage to the coffee, extensive new plantings must be made if the plantations are to continue on anything like their former scale.

At the time those plantations were made there was no question of varieties. Only a single variety was available to the planter. To-day he may choose any one of more than a dozen different sorts of coffee. Among these, Excelsa coffee has proved of particular promise for planting under certain conditions, and the experiment station wishes to place the information relating to it before the planters.

This variety was discovered about twenty-five years ago in West Africa. It was soon tested by the Dutch in Java, and presently hundreds of acres there were planted to it. Seeds of Excelsa coffee from Java were planted by the station at Mayaguez in November and December, 1915. Those plantings to-day are showing us something of what we may expect of this variety.

The discoverer of Excelsa coffee, Aug. Chevalier, reported that it is adaptable to a dry climate, mentioning it as found in one locality with a six month dry season and only 1 to 1.5 meters rainfall in the year.

In the wild state it grows in forests below 500 meters altitude and this natural range is presumably the best suited to it. Dr. Cramer of Java says that while it may be grown at more than 4,000 feet it would hardly pay at that altitude and the growth is much slower.

Excelsa may be grown with or without shade, an important adaptability at the present time with the shade trees so extensively damaged or destroyed. At the station it has grown well both under shade and unshaded. In Java it is said to be grown generally under shade, but a lighter shade is preferred for it than that used for other coffees.

Though Excelsa coffee will, of course, grow better in a rich soil, it does not require such, and will flourish in soils unsuited to the best development of Arabian coffee. The root system is notably strong and vigorous, and from the older trunks large roots may be traced far out from the tree.

Chevalier reported Excelsa coffee in the wild state to be a tree from 8 to 15 meters and even sometimes 20 meters high. Grafted trees at this station have attained a height of about 23 feet in 9 years. The growth is very vigorous and the trees attain so large a size that they must be widely spaced. In one of the station plantings the branches of 13-year-old trees spaced 12 feet apart now meet. A closer permanent spacing than 12×12 feet would seem inadvisable. However, where the seed supply is abundant and land scarce, a closer planting may be made and alternate trees removed as the growth warrants. In this way the earlier crops will show a higher acre production, but the planter will likely have difficulty in persuading himself to destroy perfectly good trees when they begin to crowd one another.

It is readily seen that the picking of the crop from trees so tall as Excelsa is not an easy matter when the planting is on a steep slope. Even though most of the trees at the station have been topped at 12 feet, ladders have had to be used and on steep slopes that is difficult. It is quite probable that on steep slopes the trees should be kept at such a height as to make ladders unnecessary in harvesting the crop, even though the lower heading-back of

* Reprinted from the *Agricultural Notes*, No. 45 of December, 1928, published by Porto Rico Agricultural Experiment Station, Mayaguez.

the tree should result in a somewhat reduced production. On more nearly level land where ladders can be used the trees should not be allowed to grow above 12 feet in height. If the tree is allowed to attain this height before being topped, there will have been a loss of irreplaceable lower primary branches. The initial topping should be when the tree is small and still retains the first primary laterals. When four pairs of laterals have developed is a good time to top. Growth will then be forced into the laterals and they will develop into large branches. When they have become strong and well-developed, an upright branch may be allowed to grow from the trunk and carry the growth up to the desired height.

The leaves of Excelsa coffee are of much stiffer, heavier texture than those of the Arabian coffee and are larger, measuring 8 to 12 inches in length and 4 to 6 inches in breadth. They are much less subject to leaf miner injury. Although the leaf miner enters, it makes little headway. For localities where the ravages of this pest are excessive, the planting of Excelsa coffee rather than Arabian is recommended.

The crop begins to ripen in December or January and continues into the following summer, thus ripening in the months when the Arabian coffee is not being picked and when labour is most readily available on the coffee plantations as constituted to-day. This variety is much less liable to loss from over-ripeness than is the Arabian coffee, and in consequence there may be longer intervals between collections. The ripening season coincides with the drier weather, which favours the picking of the crop. Since the cherries are quite immature and many of them still small in the hurricane season, the probability of wind damage to the crop is less than in the case of the Arabian coffee, provided, of course, that the tree itself is not broken, blown over, or killed.

The pulp is firmer and less juicy than that of Arabian coffee. It is thinner, however, than that of some other members of the Liberian group to which Excelsa belongs, and the machinery ordinarily used in pulping Arabian coffee may be used for Excelsa.

The cherries on the average are smaller than those of the Porto Rican coffee but there is little difference between the two in bean weight. The loss in weight on removal of parchment is about 26 per cent. for Excelsa in contrast to 17 per cent. for Porto Rican. While an almud of cherries of Porto Rican coffee is generally considered as the equivalent of 5 pounds of coffee beans after removal of parchment, an almud of Excelsa gives but 4 pounds of cleaned coffee. This makes the picking of Excelsa relatively more costly. The total reduction in weight from cherry to marketable bean in samples prepared at the station was in the ratio of 7.2 to 1. That is, for one pound of coffee as marketed, 7.2 pounds of coffee cherries were picked.

The bean is of a totally different appearance from the Porto Rican and for marketing purposes the two should not be mixed. The silver skin is of a pale brownish colour and the bean is straw-coloured or yellow. A considerable portion of the silver skin adheres to the beans, giving them a rough and uneven appearance, unless they are rapidly dried by artificial heat. A fragment of the parchment is likely to be held in the deep sutures, which also detracts from the appearance.

The quality of the beverage prepared from Excelsa coffee is good and would be acceptable locally. In marketing this coffee could not be sold as Porto Rican, to which it is much inferior in appearance, but would be classed presumably as Liberian, to which it is more closely related.

The rate of production of Excelsa coffee in Porto Rico to date is shown in the accompanying table. Each of the four groups contains from 10 to 40 trees, but the production is raised in the table to an acre basis calculated on the area planted and a reduction rate of 5 liters of cherries to one pound of coffee after drying and the removal of the parchment. Each group except D, the smallest, has lost some trees. The production is accordingly smaller than had the stand been complete, but this is a normal condition and such as ordinarily might be expected on the plantation. Groups A and B are the oldest, and group A is the largest as well, originally set with 40 trees and now containing 37. In both groups the trees are spaced 12×12 feet. In A the trees were topped at 12 feet when a little less than 7 years old, in B the growth has been unchecked. In groups C and D the trees are spaced 10×10 feet. At six years the trees in C were topped at 12 feet and those in D at 6 feet, this operation in the latter group entailing some loss of crop. The soil in which these trees are growing is certainly not superior in fertility to that of the average coffee plantation, and some of it would be considered very poor. No fertiliser has been applied to it.

ANNUAL RATE OF PRODUCTION PER ACRE IN POUNDS OF
COFFEE, PARCHMENT REMOVED.

Age of Trees.	Group A.	Group B.	Group C.	Group D.
Years.	lb	lb	lb	lb
5	57	33	—	—
6	275	168	64	41
7	238	187	55	139
8	652	417	209	—
9	204	814	211	—
10	970	28	348	—
11	585	63	—	—
12	946	895	—	—

The table shows that production began at 5 or 6 years from planting the seed, but that no large production was had under 8 years. In group A the average annual production from the 8th to the 12th year was 671 pounds, a very satisfactory yield. In the smaller group B for the same period this was 443 pounds. In group C the production has been less satisfactory, which may be ascribed, at least in part, to late topping and too heavy shading.

In summing up, Excelsa coffee possesses certain advantages and certain disadvantages in comparison with the Arabian coffee grown locally. It is less exacting in its shade requirements and may even be grown without shade. Its adaptability to a dry climate renders it less subject to injury from a protracted dry season. The vigorous root development and robust tree growth even on poor soils indicate this to be a promising variety for planting in many localities less suited to the more exacting Arabian varieties. Its resistance to the leaf miner is an attribute of paramount importance in some sections. The yield is comparatively high and the crop, ripening as it does in the drier months of the year, is much less liable to loss through wind or rain. The cup quality is good.

Against these good points, there are several less favourable characteristics. Excelsa is late in reaching full production. The reduction in weight on curing is high, an almud giving 4 instead of 5 pounds of cleaned coffee. On account of the less attractive appearance and the smaller established demand for coffee of this type, the product would be less readily marketable at a good figure.

TOMATO GROWING IN THE TROPICS.*

A FEW HINTS.

By J. M. CALWAY.

ONE of the difficulties that tomato growers in Fiji have had to contend with in the past has been the absence of a local market to absorb that portion of their fruit which matured between shipments, resulting in the loss of an appreciable percentage. Now, however, that a start has been made in the canning industry it is possible that someone may become interested in using the tomato for this purpose. In which case, if the surplus could be canned at prices that would cover expenses, tomato growing for export should offer encouraging prospects, either as a side line or, whilst waiting for more permanent crops to mature.

Fiji is fortunate in possessing a near overseas market, demanding this fruit and being itself unable to economically supply it during several months of the year.

Few plants crop so heavily in so short a space of time, whilst, when cultivated on scientific lines and with the advantage of a tropical climate, the capital outlay is also small. From ten to fifteen tons per acre may be harvested, commencing to mature two months after planting, whilst planting can be carried out during eight months of the year.

Tropical conditions do not, however, allow the methods practised in temperate regions to be followed exactly, so that the following notes may prove useful to those who would like to try this fruit commercially.

Almost any soil in Fiji will be found suitable, except very loose and sandy types, providing that a fair amount of humus (decaying vegetation) has been worked into it, whilst a dusting of ashes, and a little blood and bone manure, where the plants are set, helps. Well rotted horse, or cow manure is equally good. It is not advantageous to use nitrates, which accelerate the growth of foliage at the expense of fruit, and without which the plant grows, in the tropics, at an abnormal rate.

Diseases can be dealt with in the same way as in temperate zones. Fiji is not, however, at present seriously troubled in that way, the most important being "wilt." This can be minimised by strict attention to "mulching" and seed selection, whilst it also helps if seed is selected from those of your own plants which have shown natural resistance to this trouble.

SEED-SOWING.

Sowing in the open is not recommended, the chance of raising a good batch of seedlings being very remote. A heavy rainfall flattens them when small, or a hot sun following "cooks" their roots, whilst in the earlier stage, the seeds may be battered to varying depths, defeating the object of uniform development.

Apart from these risks, even in the event of a good batch being raised, the plant is so tender as a seedling that it does not recuperate easily from open bed transplanting.

Good seed-pans can be made from benzine tins, or cases, and need only be two or three inches deep.

The soil should be fine enough to go through a quarter inch sifter, but it should *not* be rich in plant-food. When placed in the seed-pan it should be lightly patted with a board so that a fair level may be had, to ensure uniformity of growth from the start. Water lightly and distribute the seeds evenly over the entire surface and then cover lightly with fine soil,

* Through the courtesy of Mr. J. M. Calway, who is the authority for this article.

using only sufficient to just hide them. Press lightly again with the board, so that the seeds are firmly embedded in the moist soil underneath. Keep the seed-pans under cover and away from wind, in order that repeated watering may be avoided.

SEEDLINGS.

The seedlings require an even distribution of light otherwise they will neither grow sturdily nor upright. Thus, if the seed-pans are placed against a wall, the young plants will quickly stretch towards the light, and soon become spindly, the same effect being produced if the overhead cover is low and excludes the light. This can be rectified by turning the seed-pans daily.

When the second pair of leaves are developed the seedlings may be "pricked off."

"PRICKING OFF."

It may seem that moving the seedlings from one tin to another is a needless waste of time and labour, but such is far from the case. The spacing of the young plants in a good rich compost for a few weeks, before finally planting out, is very essential in the tropics, the success of the crop largely depending upon how well this operation is carried out.

A compost of fine loam, containing from 20 per cent. to 25 per cent. of humus, a little blood and bone manure and a dusting of ashes, should be well mixed before being put through a quarter inch sifter. Boxes or tins similar to those used for seed sowing, but with suitable drainage holes made in the bottom, are filled with the compost. Press the surface firmly with the board and give a little water.

Use a small round stick, like a pencil, not too sharply pointed, for levering the seedlings, after watering, out of the seed-pans, and also for making the shallow holes in the compost to receive them. Put the seedlings two inches apart in the new container.

The half of a benzine tin cut to suit will thus carry two dozen plants comfortably (6×4).

To protect the plants until they are strong enough for the field a light frame should be erected. This should stand clear of any outbuildings or trees, so that there will be an even diffusion of light. The roof should be made to carry "scrim" or light sacking only. This should slope away from the ridge to either side at an angle of 45° . The "scrim" is tacked on to the ridge, but fixed at the bottom, so that it can be rolled up or let down at will. A thin piece of lathing or bamboo, fixed along the bottom, will act as a weight to keep it tight when down and, as a roller when necessary to put it up.

The tins of plants may be placed on boards and trestles of an improvised nature to keep them away from ground pests. A frame eight feet wide, and long enough to carry seven yards of scrim on either side, will protect sufficient plants to fill over an acre of ground, and it can be refilled every twenty-five days during the season. The blinds are necessary to exclude the mid-day sun and to break the force of heavy rain while the plants are still small. They are lowered at night, but from early morning, until the sun is too hot and from early afternoon until sunset, every advantage should be taken of the light, except during heavy rain. As the plants grow stronger the overhead protection should be gradually removed.

The advantages gained by the use of the frame and pricking off are as follows:—

1. Protection to the plants in the early stages.
2. "Checking" them by the "pricking off" process.

3. Exclusion from the effects of abnormal sun, and rain conditions.
4. Premature flowering is avoided. Plants introduced to the tropics from the temperate zones if cultivated from seeds in the open ground are likely to be affected with "premature flowering". The abnormal condition "force" the plants to bloom and seed before they have had time to grow sufficiently strong. This causes them to dry off from exhaustion when only a few inches high, leaving only miserable specimens of fruit that cannot be used.
5. The protected plants, in good compost, make better progress than they would in the open and being concentrated, the number that would otherwise cover an acre can be attended to in a few minutes each day.
6. Losses from subsequent transplanting are avoided, as the tins can be taken out to the actual planting spot before being disturbed. It will then be found that each plant will carry with it a solid block of the compost when taken out of the tin, sufficient in food value to enable it to establish itself.

PLANTING OUT.

Planting is best done on cloudy weather or, if this is not possible, during the late afternoon.

If the tins have been well watered, before the plants are disturbed, it does not matter much if the land is fairly dry.

Place the plants four feet apart, leaving at least four feet between the rows, to allow a passage for tying and thinning.

After planting, the most important item, and one that must not be neglected, is the application of a mulch. This may consist of grass clipping, dried grass, leaves or any vegetable matter, placed round the stem of each plant one inch deep, and covering at least one square foot of ground surface. This will be found to prevent overheating of the soil, thus obviating "wilt" and in addition conserving moisture. It is also labour saving, making watering seldom necessary. If the plants are not mulched, constant watering does not prevent wilting, but rather tends to promote the trouble.

The mulch must not be piled against the stem, as it induces stem rooting above the ground, which is most undesirable. If the plants are put in firmly and the soil levelled off, the mulch only requires to be spread on the surface.

STAKING AND TYING.

Stakes six feet long should be driven into the ground to the depth of a foot, at a distance of three or four inches from the stem of each plant. This should be done as soon as possible after planting, to prevent injury to the roots.

Coarse binder twine is the most suitable material for tying purposes, the first tying taking place when the plants are about eighteen inches high. This should be repeated at eighteen inch intervals as the plant progresses.

The twine is twisted twice round the stake and is only used to pull the stems of the plant in, not to completely encircle it, which would tend to strangle growth. Care should be taken when tying not to confine any of the young fruit between the stakes and the stem, such fruit becomes cramped as it matures.

THE ONE-STEM SYSTEM.

There is only one way to grow good table or export fruit, that is by the "one-stem method." The bush system, generally practised, has nothing

to recommend it, and for commercial purposes should be prohibited. The plants grow, spread over the ground, where they cannot be nourished, or watered, without the fruit being splashed. Heavy rains batter the latter against the ground, soiling it, whilst many of the flowers produced have little chance of setting in the tangled mass, which is rarely dry and gets little sun. Only the upper portion under these conditions, is productive, and the fruit produced is generally irregular in size and shape, and may range in weight from an ounce to a pound, putting grading economically out of the question. Contrary to local opinion, such big fruit is no advantage in the oversea market.

The "one-stem system" keeps the fruit away from the ground, so that both flowers and fruit get the maximum of sunlight, and the plant is only called upon to produce what it can support. The crop is of a more uniform size and can be graded without difficulty. Starting from the first truss, about eighteen inches from the ground, each truss or bunch matures in turn up the whole length of the stem and it is a simple matter to calculate what quantity will be available for shipment.

From the beginning all laterals (side shoots) must be removed. This operation has to be attended to continually, as they grow quickly absorbing much of the vitality of the plant. By rubbing them off as soon as they appear, a large area can be gone over in a very short time; whilst the strength of the plant is not taxed to promote growth that will be later removed.

GRADING AND PACKING.

Tomatoes for export can be harvested as soon as the creamy spot shows through the green skin. They should be picked into large trays in order to avoid bruising.

The standard size for marketing is a little smaller than a tennis ball. The market demands 3 or 4 to the pound. Larger fruit is not a marketable proposition.

There need not be more than three grades—

1. A little above standard size.
2. Standard size.
3. A shade smaller than standard size.

Great care should be taken in this matter. It will be found that the "one-stem plant" produces a crop that can be absorbed by three grades without difficulty, but under the "bush system" grading is a practical impossibility, not only because the fruit varies tremendously in size, but it is often unshapely.

Each layer in a case should be protected from its neighbour by a sheet of white packing paper in order to minimise bruising, and retard ripening. One over-ripe tomato in a case can be more deadly there than it ever was at an election meeting.

To achieve success the main points to be observed are—

- (1) Protect and bring forward the young plants under cover for as long a period as is consistent with field planting.
 - (2) Pay strict attention to mulching *after* planting out.
 - (3) Work on the single-stem plan.
 - (4) Look upon packing and grading not merely as a means of disposal, but as the most essential part of the whole business.
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TAILEVU DAIRY SCHEME.

A HISTORY OF THE TAILEVU DAIRY SCHEME TOGETHER WITH
A REPORT ON THE PRESENT POSITION OF THE SCHEME
AND RECOMMENDATIONS FOR ITS FUTURE MANAGEMENT.

By J. D. TOTHILL, D.Sc., Superintendent of Agriculture.

INTRODUCTION.

WHEN the Tailevu Dairy Scheme was first agreed to by the people of this Colony one of the avowed purposes was to establish a new industry in the Colony. As a direct result of the Scheme there are now three butter factories in the Colony and the value of the new industry is shown in the following figures of production starting from the day on which the first pound of factory butter was made at Korovou:—

<i>Year.</i>	<i>Pounds of Butter.</i>	
1920		
1921		13,104
1922		23,785
1923		59,219
1924		143,219
1925		168,844
1926		247,727
1927		302,513
1928		313,655

1,272,066 valued at 1s. 9d. lb = £111,305.

The question of land settlement for returned soldiers was first brought up in Legislative Council by the then Governor, Sir Cecil H. Rodwell, in the form of a Message laid on the Table on 1st July, 1919 (C.P. No. 37 of 1919). As annexures to the Message were schemes of land settlement prepared by the Lands Department one of which was to make lands in various parts of the Colony available to returned soldiers on very easy terms and another of which was to arrange for six selected settlers to grow coffee on the Waimaro.

After a discussion (p. 148, 1919 *Hansard*) Council passed the motion:—

“That the Council approve of the principle of assisting Returned Sailors and Soldiers on the lines proposed provided that the expenditure involved from Public Funds does not exceed £6,000 and recommend that a Special Committee be appointed by the Governor to consider the details of the Scheme referred to in the Message and any other questions affecting the welfare of Returned Sailors and Soldiers.”

THE CROMPTON COMMITTEE.

The members of this Committee were—

The Hon. R. Crompton, C.B.E. (Chairman).
The Hon. Acting Attorney-General.
Superintendent of Agriculture.
District Commissioner, Rewa.
Mr. E. Duncan.

And their report became Council Paper No. 2 laid on the Table on 7th May, 1920.

This report is a very complete document and shows that the Committee went into the matter with great care and in elaborate detail. The Committee advised against the land settlement schemes referred to in the above

Message and recommended unanimously that the Government should endeavour to establish a Dairy Industry. Detailed proposals for establishing this industry at Tailevu constituted the main part of the report.

The scheme proposed was the starting point for the one now in operation but a few points of difference may be noted:—

- (a) It was estimated to cost £52,080 whereas it has actually cost approximately double this sum.
- (b) It was proposed that the factory part of the scheme should, as soon as the factory was built, be run as a Private Limited Liability Company "with a nominal capital of say, £10,000 divided into 10,000 shares of £1 each" and that each tenant be compelled to take four shares for each heifer supplied to him, the shares to be paid for at the rate of 2s. 6d. on application, 2s. 6d. on allotment and the balance to be deducted from the monthly cream cheque at a rate not to exceed one penny per lb of butter fat.
- (c) It was proposed that £2,000 be devoted to sending the prospective tenants to the Hawkesbury Agricultural College or other suitable place for six months to receive tuition in dairying, whereas in the scheme as adopted provision was made instead for a qualified dairyman to oversee the scheme and provide the instruction.

MESSAGE NO. 3 OF 1920.

In Message No. 3 of 1920 the Governor invited the attention of Council to the report and suggested that without committing itself to the details of the scheme Council should "approve generally of the establishment of a dairy industry on the lines recommended in the report; that a sum of £2,300 (a clerical error for £3,300) be voted for the acquisition of the areas in the Tailevu district named in the report; that a sum of £2,000 for the proposed training be voted and that Council approve in principle of providing the funds estimated at £17,000 per annum for three years."

The Hon. R. Crompton moved for the adoption of the Message, the motion being seconded by the Superintendent of Agriculture. In the ensuing debate both sides of Council supported the proposals very fully, the only criticisms offered coming from the Hon. R. Harricks and the Hon. F. C. Clapcott (pp. 54 55 *Hansard* 1920) who thought that it would be better to substitute the acquisition of a dairy expert in Fiji for the proposed training at an agricultural college of the individual tenants. The Hon. F. C. Clapcott also said "I am going to support the motion but at the same time would point out that so far as the returned men are concerned it is possible that the scheme will be a failure for them because we are asking these men to do the hardest work there is. We are asking them to experiment."

With these minor criticisms it was unanimously agreed "That this Council approves of the Governor's Message No. 3 of 1920 and authorises the expenditure."

PROGRESS UNDER THE FIRST COMMITTEE OF MANAGEMENT.

A Committee of Management was then set up with the Superintendent of Agriculture as Chairman and the scheme was proceeded with. Mr. P. Waller was appointed by the Committee as Dairy Instructor and his first report, dated 9th December, 1920, was printed as Council Paper No. 2 of 1921. This report shows that 140 acres had been cleared by that date and that matters generally were moving forward.

One of the reasons put forward for selecting Tailevu lands for the scheme was that as every farm had access to navigable waters it would be unneces-

sary to incur heavy expenditure for road construction. The waters were considered by Mr. Waller to be unnavigable and in this first report he says: "I must therefore press for the construction of the roads as a very urgent matter." In the same paper Mr. Knowles, in a report to the Hon. the Colonial Secretary, states that arrangements for the roads were being made accordingly. Mr. Waller also advised that a twin screw launch being built for the scheme would be excessively expensive to operate but the contract had been let and the launch was completed.

MESSAGE NO. 1 OF 1921.

In Message No. 1 of 1921 (C.P. 5 of 1921) the Governor, Sir Cecil Rodwell, recommended, on advice of the Committee of Management, that costs of instruction, imported stock and administration, amounting to £4,050 should be met from General Revenue and be considered as non-recoverable from the tenants. The motion for the adoption of this Message was agreed to on 13th April, 1921 (p. 51 *Hansard*) and an interesting point brought out in the debate was that it was the intention of the Committee of Management to use the imported bulls for the establishment of a stud farm for the benefit of the whole Colony.

Provision was also made for the importation of machinery for the factory on a duty free basis (p. 38, 1921 *Hansard*).

THE HON. F. E. RIEMENSCHNEIDER BECOMES CHAIRMAN OF THE COMMITTEE OF MANAGEMENT.

When Mr. Knowles was transferred to the Gold Coast the Hon. F. E. Riemenschneider became Chairman of the Committee of Management and a report, under date of 29th October, 1921, was printed as Council Paper No. 56 of that year. A balance sheet attached to this report shows that the sum of £48,364 6s. had now been expended, the factory was ready for handing over, but there was still an insufficient supply of cream to make factory operation possible. The report also shows that the difficulty of accumulating dairy cows had been apparently partially solved by the purchase of 400 Ayrshire cows from Messrs. Tarte Bros.

SCHEME ARRIVES AT A CRITICAL STAGE.

The scheme had now arrived at a critical stage. The funds originally contemplated had been spent. The factory was complete but pastures were not ready and insufficient cows were available to produce sufficient cream to enable the wheels of the factory to turn. Moreover, the road from farms to factory was not complete and without a gravel surface was of little use for the transport of cream. Finally, when the cows began to arrive from Taveuni it was found that they were unsuited to the needs of the scheme.

THE SCOTT COMMISSION OF INQUIRY.

A Commission of inquiry was therefore appointed by the Acting Governor on the 25th of January, 1922, to inquire into the management and progress of the scheme, the Commissioners appointed being the Hon. H. M. Scott, K.C. (Chairman), J. J. Barker and G. C. Foulis.

The Commission found (Council Paper 24 of 1922) that the cattle purchased from Tarte Bros. were wholly unsuitable for dairy purposes and recommended cancelling the contract on the best terms possible. It held that all members of the Committee of Management at the time of the purchase were responsible for an ill-advised transaction and recommended that the Committee be disbanded. It reported that the progress of the scheme generally could not be regarded as satisfactory.

A series of recommendations were made involving a very large further estimated expenditure of £34,800 7s. 11d. of which amount £8,130 was in hand under the control of the Committee of Management. More than half of this was for further advances to settlers; £2,000 was for gravelling the road, £2,000 was to finance a demonstration farm at Tailevu, £2,100 was for a manager's salary for two years and for a factory loss for eighteen months.

As to control, although the original scheme contemplated handing the factory over to a Limited Liability Company with the producers as compulsory shareholders according to their quota of cows, the Commission evidently considered that the time was not ripe for such a step and recommended placing control in the hands of a salaried manager who would reside at Tailevu and be responsible for expenditure directly to the Government.

DEBATE ON THE SCOTT COMMISSION REPORT.

The subject matter of this report was discussed at length in Legislative Council on 8th June, 1922 (pp. 60-68 *Hansard*) and the seriousness of the position is reflected in the debate. Government undertook to look into the question of the advisability of removing the scheme to Rewa or to Navua where the difficulty of transport to Suva would be overcome. The conclusions of the Commissioner's Report were finally agreed to but not the recommendations involving further heavy expenditure. The motion agreed to, which was moved by the Hon. the Colonial Secretary, the late Mr. T. E. Fell, C.M.G., and seconded by the Colonial Treasurer, Mr. H. H. Rushton, who had recently arrived in the Colony, reads as follows:—

"I move: By direction of the Governor that this Council agrees with the conclusions expressed by the Commission in paragraph 49 of the report and approves of the expenditure from Public Funds of a sum of £4,000 in order to carry on the Tailevu Dairy Scheme for a period of three months within which time the report of an expert may be obtained as to the best means to be adopted to place the scheme on a sound permanent footing and to render it eventually self-supporting."

Mr. George M. Valentine, Dairy Instructor for the New Zealand Government, was then invited to come to the Colony and report upon the scheme. In the meantime, Tailevu matters improved sufficiently to enable the Governor, Sir Cecil Rodwell, to say in his address to Council on 7th December, 1922 (Council Paper 50 of 1922) "The prospects of the Tailevu Dairy Scheme are much more satisfactory than they were six months ago. It may be too early to speak of the scheme as an assured success, and money has been wasted which can never be recovered, but I think it may now be said that the worst corner has been turned."

MR. VALENTINE'S REPORT.

Mr. Valentine's Report was tabled on 15th December (Council Paper 74 of 1922). In view of wide experience in dairying matters his report is of particular interest and largely on his advice Government decided not to abandon the scheme. He says: "I am convinced that there are large areas of good land on which dairying can be successfully carried on, not only at Tailevu but wherever a sufficient area is available." He thought that Rewa would have been a better place to start a factory than Tailevu but that, having been started at Tailevu, the scheme should be continued there. He stressed the importance of connecting the scheme by road to Suva. He was opposed to the Tavuni cattle purchase and also to that of the twin screw launch. In the report it was pointed out that one of the unforeseen

expenses had been the high cost of bringing bush land under grass and that a mistake had been made in felling so much bush in the first instance, that weeds came in before the land could be grassed; experience had shown that it paid to reclaim the bush land slowly. However, in spite of all the mistakes some of which were due to mismanagement and some to inexperience, Mr. Valentine was of opinion that "the scheme has now reached the stage where its success is assured provided the tenants put their best work into it." A reassuring feature in the report was the result of milk tests which showed that "the average fat content of the milk samples tested at the factory was 3.79 per cent. practically the same as New Zealand at the time of lactation." Of those tested "the best herd averaged 636 lb of milk containing 25.35 lb of fat in 30 days."

As to future management, the report says: "the formation of a Co-operative Dairy Company to take over the factory will be necessary as time goes on and "probably some time will elapse before the tenants are in a position to form such a company but until the company is formed I would suggest no alteration in the present system of management . . . Mr. Rushton, the Treasurer, has controlled and directed the financial and economic side of the scheme with unusual ability and foresight." The "present" control referred to was direct Government control through the Treasurer with a resident manager at Tailevu, Mr. Hamilton, being responsible directly to the Treasurer.

PURCHASE OF VUNA CATTLE COMPLETED.

Mention has been made several times of the purchase of 400 cattle from Tarte Bros. at £12 per head. In view of the unfavourable report on this transaction by the Commission an opportunity was given Messrs. Tarte Bros. to withdraw from the contract. They did not, however, take advantage of this opportunity and the balance of the cattle was taken over in December, 1922, after being tested for tuberculosis. In a report under date of 24th January, 1923 (Council Paper No. 4), Mr. W. Hamilton says of these cattle: "It is difficult to say what the value of a selection of 400 at the date of purchase was, but I can definitely say that, as a dairy farmer, I would not have purchased 400 of such a herd for myself at any price although it is quite possible that at that date when prices were running high, a selection of the 100 best might have been worth £12 each." The Government Veterinary Officer, Mr. McKenzie told the Treasurer at this time that in his opinion the value ranged from £5 to £6 each plus whatever increased value the passing of the tuberculosis test might be deemed to give them.

A PROTECTIVE DUTY IMPOSED ON BUTTER.

In December, 1922, a protective duty of 2d. per pound was imposed for a limited period of six months. At the close of the following year assistance was given to the industry by the passage of a Bill (*Hansard* p. 178) to amend the Customs Duties Ordinance 1921 so as to provide a duty of 4d. per pound on butter manufactured in the British Empire, part of this to be regarded as a protective duty for the nursing industry. In the debate on the motion it is stated that while astonishing progress had been made at Tailevu it had been necessary to pay 1s. 6d. per pound for standard grade butter fat in order to keep the settlers going. Many of the settlers had neither sufficient grass nor cows although all but two had become self-supporting. It is clear from this debate that the factory wheels were now turning, butter was being sold readily in Suva, and progress had been made.

THE DAIRY INDUSTRY ADVANCED BY THE ERECTION OF TWO FACTORIES AT REWA AND NAVUA.

On 21st November, 1924, the Acting Governor, the late Mr. T. E. Fell, C.M.G., said in an address to the Legislative Council (Council Paper No. 45 of 1924): "The dairy industry continues to progress; companies have been formed at Rewa and Navua and a new factory on the Rewa has been opened during the year."

ANOTHER DIFFICULT PERIOD AT TAILVU.

In the meantime a Committee had been appointed by the Governor, Sir Cecil Rodwell, "for the purpose of considering the future of the Tailvu Dairy Scheme."

This was appointed as a result of a motion by the Hon. Alport Barker, Member for the Southern Division, who had in company with the two other Country Members spent two days examining conditions at Tailvu. The debate on this motion (pp. 90-96 *Hansard*, 1924) gives a picture of Tailvu that is steeped in gloom. Amongst other things, the Hon. Alport Barker says of the original report on which the scheme was based that he can "only characterise the framing of that report as so mistaken and ill-advised as in my opinion to be criminal." Of the settlers he says: "I foresee the time when they will give up in despair and gradually one by one drift from the scheme, killed by the Hindenburg line of curse." The solution is to transfer to the Rewa or to the Sigatoka. "I strongly favour the idea of transfer as the only salvation of the men" and later he says: "I was always against Tailvu as a site for the scheme and was always in favour of Rewa." The Hon. P. W. Faddy said: "I cannot see any one bright spot appearing in the whole of the scheme." He emphasised the lack of sufficient flat land on each farm and suggested a rearrangement of the farms or transfer as the solution. The Hon. A. H. Roberts said: "that something has got to be done for the men, either to transfer them to another district or to extend the flat lands as the men themselves perhaps would prefer." It is interesting to note that in accepting the motion the Governor, Sir Cecil Rodwell, said: "It is one of the most doleful stories I have ever heard and it is very difficult for me to understand with what extraordinary rapidity the position at Tailvu must have changed. It is only a few months ago that one of the best New Zealand experts, Mr. Valentine, reported most favourably on the prospects of the settlement," and at the close of his speech said: "I still believe in spite of the doleful picture that has been drawn that the dairy industry in this Colony will prove to be a success."

WORK OF THE RUSHTON SPECIAL COMMITTEE.

The Special Committee appointed "for the purpose of considering the future of the Tailvu Dairy Scheme" consisted of the Hon. H. H. Rushton (Chairman), the Hon. Alport Barker, R. Crompton, C.B.E., K.C., F. C. T. Lord, Esq., and L. N. Bean, Esq., and the report of this Committee, dated 6th July, 1925, appears as Council Paper No. 34 of that year.

In the debate referred to above that gave rise to the appointment of this Special Committee three possible courses had been suggested—

- (a) Abandonment of the scheme
- (b) Transference to another site; and
- (c) Reorganisation.

The Committee recommended drastic reorganisation including a rearrangement of the farms so as to reduce them in number from twenty to thirteen

and so as to provide each farm with approximately 100 acres of flat land. In the matter of finance it was shown that if certain small additional expenditure incident upon the proposed reorganisation were approved the scheme to 31st December, 1923, would have cost £85,826; it was stated that an official valuer, Mr. Mackie, lent by the courtesy of the Government of New Zealand, had placed a value of £29,237 upon the farms and factory but that the Committee considered this should be reduced to £25,000 (£19,500 for farms and £5,500 for the factory). It recommended that the difference between these two figures, namely, £60,826 should be written off as expenses incurred in the establishment of a new industry.

As to control, the Committee recommended that the time was not appropriate for forming the Co-operative Company contemplated in the original Crompton Committee Report and that, for the present, control should remain in the hands of the Government but that a local committee should be set up of four settlers (two nominated by the settlers and two by the Superintendent of Agriculture) with an official Supervisor as Chairman and Secretary and that the complete management of the factory and of butter sales be entrusted to this Committee. The report is replete with detailed recommendations but the main ones are those briefly referred to above. It may be of interest to note that the Committee without definitely recommending the construction of a road from Korovou to Naduruloulou pointed out the advantages that such a road would confer upon the settlers at Tailevu. Speaking of future development, the Committee concluded that "Hesitation is not now justified on any grounds of finance or policy."

DEBATE ON THE ADOPTION OF THE RUSHTON COMMITTEE REPORT.

A debate in Legislative Council took place on 15th July, 1925 (p. 34, *Hansard*) on the motion for the adoption of this report which was moved by the Treasurer and seconded by the Hon. Alport Barker.

The report had stressed the advantages that would accrue to the settlers if the leasehold tenures could be converted into freehold. In the debate this point was emphasised particularly by the Hon. Alport Barker and the Hon. H. M. Scott and His Excellency the Governor, Sir Eyre Hutson, said: "I would be very glad to recommend to the Secretary of State the proposals . . . in regard to acquiring this property and turning the farms into freehold. The purchase of native land is not strictly prohibited as I understand the position, particularly to the Government and particularly if the Governor can satisfy the Secretary of State that the natives' interest would not be prejudiced thereby."

The note struck in the debate was not an optimistic one but infinitely less doleful than on the occasion in 1922 of the debate on the motion to adopt the Scott Commission Report or on the occasion two years later of the debate that led to the appointment of the Rushton Committee to consider the future of the scheme. This tempered optimism in regard to the scheme is brought out in the Governor's speech as follows: "The report recommends further expenditure to a limited amount and, I regret to say, to my mind a doubtful chance either of the settlers making good in the end without further capital or the general taxpayer really recovering indirectly any substantial portion of this expenditure."

The report was adopted, subject to the condition that His Excellency reserved to himself the right to veto any of the recommendations which after consideration had been given should not in the opinion be adopted.

PROGRESS REPORT BY THE COLONIAL TREASURER.

By 25th May, 1926, the principal recommendations of the report had been carried out and a progress report by the Colonial Treasurer, together with an attached memorandum by the Acting Superintendent of Agriculture, was laid on the Table (Council Paper No. 15 of 1926).

The twenty farms had now been reduced to thirteen and each tenant had approximately 100 acres of flat land.

On the financial side the report disclosed that the scheme had now cost £86,933 of which £15,550 had been charged against loan funds and £71,383 charged as final expenditure against revenue.

As to control, it was recommended with a view to getting one step nearer to the formation of a Co-operative Company that the Supervisor and the Factory Manager be given full administrative joint responsibility, subject to the general direction of the Acting Superintendent of Agriculture, and that an Observing Committee of two soldier settlers and one outside supplier, all named by the Government, be appointed. This arrangement was approved and put into effect.

Two points in this report are not touched upon in previous ones and both indicate that considerable progress had been made toward establishing the dairy industry in the Colony since the Tailevu scheme was initiated in the autumn of 1920. In the first place, it is reported that considerable quantities of cream are being delivered to the Tailevu factory by outside suppliers who have had no Government assistance whatever. Secondly, it is reported that Fiji butter from the Rewa factory has made an initial bow in the Honolulu and London markets, that the consignments were graded within two points of New Zealand "superfine" and that they were reported upon very favourably.

The Acting Superintendent of Agriculture who had visited Tailevu for the first time came to the conclusion that: "there is to-day a reasonable chance of Tailevu becoming a permanent dairying area. The two outstanding points, seeming to indicate that the more important difficulties have been overcome, are the enthusiasm of 85 per cent. of those in the scheme and the fact of there being seven outside suppliers, with good prospects of others."

FURTHER DIFFICULTIES.

A further series of disappointments occurred during the next six months. These formed the subject of a Memorandum by the Treasurer printed as Council Paper No. 35 of 1926, and of a somewhat depressing debate in Legislative Council on 31st May (p. 42 to 48 *Hansard*).

Cash to the value of £235 4s. 10d. was stolen from the scheme safe; two of the most experienced soldier settlers left the scheme and went to Navua; 257 boxes of butter held in storage became unfit for sale as first class butter and had to be sold at greatly reduced prices; and the settlers asked that further concessions be granted in the form of reduction of rents and of the capital value of farms. The debate was concluded by Council granting the concessions previously urged by the Hon. H. M. Scott, the chief of which were the reduction of rents from 5s. to 2s. 6d. per acre for flat lands, the reduction of capital value of the farms from £1,500 to £1,000, and appropriating from General Revenue the sum of £2,500 to meet the unforeseen additional expenditures for the year.

CHANGE OF MANAGEMENT.

A slight change was made at this time in the management. The Manager at Tailevu was dispensed with and his duties taken over by Mr. A. B. Ackland,

subject to supervision of the Superintendent of Agriculture in technical, and of the Colonial Treasurer in financial matters, this arrangement having continued in force until the present time. The Observing Committee already referred to has also been extant and from time to time has taken an active interest in the management of the factory and of the scheme generally.

GOVERNOR'S MESSAGE NO. 5 OF 1927.

For a year and a half the reorganised scheme carried on without the aid of Commissions, Select or Special Committees and was not heard of until 13th October, 1927, when it came up for further consideration in the Governor's Message No. 5 (Council Paper No. 63 of 1927). This document is notably different in tone from most of those referred to in this history of the scheme and shows that at last the many difficulties were being overcome. Better cold storage facilities at Tailevu were now available and Leylands & Compnay in Suva who had become the agents had agreed to provide modern facilities capable of dealing with butter for local sale and for export. Losses on butter through faulty storage had become fewer and the annual deficit on working account had reached the vanishing point.

The Message states that the total capital expenditure on the scheme is estimated at £84,076 of which £58,350 has been written down with the approval of Legislative Council and of the Secretary of State and that in addition there has been a total working loss of £5,150.

The Superintendent of Agriculture in an annexure to the Message had recommended—

- (a) a further two-year trial of the scheme with management unchanged;
- (b) filling vacant farms with experienced dairy farmers;
- (c) attempting to convert the scheme into a co-operative one at the end of 1929; and
- (d) building without delay the road from Tailevu to Naduruloulou.

These recommendations were approved by His Excellency who embodied them in the Message.

The debate on the motion for the adoption of this Message (pp. 109-119, *Hansard* 1927) was not of the gloomy kind and the Message was adopted unanimously. The debate itself was actually on a side issue, namely, how best to secure some return to General Revenue for the increased value of the lands traversed by the proposed road and no serious objections to the Message were put forward by any members of Council.

It is interesting to note that provision was made in the Message to provide a contingency fund of £500 per annum for the two years in question in addition to the customary loss in rents of £275 5s. but that it has not been necessary to make use of this provision in respect of the first year ending on 30th September, 1928, the books for which have just been closed.

REPORT ON THE PRESENT POSITION OF THE SCHEME AND RECOMMENDATIONS FOR ITS FUTURE MANAGEMENT.

INTRODUCTION.

In Message No. 5 of 1927 it was provided "that before the expiration of the period ending on the 31st December, 1929, every endeavour should be made to hand over control (by way of sale or otherwise) of the undertaking to the suppliers (both returned soldiers and others) on terms to be approved by this Council."

In order to take the views of the suppliers and to place himself in a better position to advise as to the immediate future of the scheme the Superintendent of Agriculture in company with the Senior Veterinary Officer, made an inspection of the scheme early in 1929 between the dates of 4th February and 11th February inclusive.

2.—ITINERARY.

February 4th.—Rode along or parallel with the new road from Naduruloulou to Korovou.

February 5th.—Inspected the farms of Messrs. Speight, Grieve and Harness.

February 6th.—Inspected the farms of Messrs. Faddy Bros., Smith and Cooper.

February 7th.—Inspected the farms of Messrs. Compain, Jr., Bannister, McMahon and Blanch.

February 8th.—Inspected the farms of Mrs. Wood and of Messrs. Norris, Clifford and Gatward.

February 9th.—Inspected the farms of Messrs. Brake, Sacks and Kellar. In the evening held a public meeting, to which all suppliers had been previously invited, at Korovou.

February 10th.—Rode to Lodon inspecting *en route*, the farms of Compain, Sr., Melika, and Mrs. Hunt.

February 11th.—Inspected the farm of Mr. Milton Craig and returned by launch to Suva.

3.—SOME COMMENTS ON THE CONDITIONS FOUND ON EACH FARM.

1. Mr. Speight. An experienced New Zealand Dairy Farmer who took up the farm at the top of the Wainewesi originally occupied by Mr. Craig. Since coming to Fiji in March, 1928, Mr. Speight has built a comfortable home on the site of the house that was destroyed by fire, has greatly improved his milking bails and has cleared all flat land on the farm of *Clidemia*. He is now milking 39 cows, expects to milk more next year and has a young pedigree Jersey bull. Has put in five acres of Paspalum on the flats and this is coming on well. He is making good progress.

2. Mr. Grieve took over farm number 4 in July, 1928. Prior to this it had been maintained during its period of vacancy through the kindness of Mr. George Harness who occupies the adjacent farm. Mr. Grieve, senior, is occupying the farm until June, 1929, when Mr. Grieve, junior, expects to take up permanent residence. In the meantime the farm has a neglected appearance and the main paddocks need weeding badly. Close to the house about three acres of land have been recently cleared. Twenty-five indifferent looking cows are being milked but there is some nice looking young stock that will eventually enable culling to be done.

3. Mr. George Harness. One of the original soldier settlers who now has a comfortable home, a well kept farm, and a good dairy herd. Milking 34 cows; expects a slight increase in production this year. Expects to plant four acres of maize for soilage purposes this year to increase production in June, July, and August. Has just purchased a good pure bred bull from Navua.

4. Faddy Bros., both original soldier settlers. Two farms operated as one unit. Seventy acres of para and 50 of ordinary flats. The farm generally in good condition; a fair milking herd is being bred up and the young stock coming along will enable more culling to be done among the old cows. A new pure bred bull has just been purchased from Mr. Kiss.

5. Mr. H. P. Smith. Another original soldier settler. Has a comfortable home and there is plenty of evidence of hard work having been put into the farm. Forty-four milking cows and a small increase is expected. Four acres recently ploughed and sown to Paspalum which has not germinated well will be sown to maize. A pure bred bull will be required, probably in August.

6. Mr. Cooper the fifth of the original soldier settlers now on the scheme. A comfortable home. A fine herd of cows with 34 now being milked. Expects to increase the butter fat supply slightly this year. Approximately 100 acres of flat land in use; no ploughing has been done for many months and the pastures are in need of renewing. With more attention to pastures this farm could be made to double its present output of butter fat. Expects to put in five acres of maize for the winter months. The farm is going back slightly.

7. Compain, junior, for a few months has operated the farm vacated by Mr. Costello at the top of the Waimaro. He is a lad of 17 and is living with his mother. Visible progress has been made in the form of fencing and ploughing. There are four acres of new para and plans have been made for three acres to be planted to maize. Sixteen cows are being milked and three heifers are due to calve this year. A new bull is required and I am informed that a brother at Lodoní is prepared to give the necessary assistance. Progress made so far is satisfactory.

8. The Lord farm. Vacated by Mr. Lord in May and still vacant. This farm has been allowed to go back steadily in the last few years and the work of clearing will have to be done all over again by the next tenant. The house and fences are in a bad state of repair.

9. Mr. McMahon. A new and energetic tenant from Australia who has taken up the lease of the farm vacated by Mr. Beveridge on account of ill-health. Expects to have the farm in good order by the end of 1930.

10. Mr. Bannister, took up in April, the lease of the farm previously occupied by Mr. Livingston and has made very good progress, the farm now being in better condition than at any time during the last four years. Has $1\frac{1}{2}$ acre of Paspalum looking very well and a further $2\frac{1}{2}$ acres either sown or ready to sow. Milking 29 cows and anticipates an increase this year. Thirty acres cleared and in pasture and expects to sow not less than four acres of maize to provide winter feed. At this stage more rapid progress could be made if an advance could be arranged for fencing, clearing and planting another 30 acres.

11. Mr. Blanch, the sixth of the original soldier settlers, has at no time made rapid progress and mentions the shortage of labour as a principal difficulty. Made considerable improvements two years ago and has since maintained the improved position. His cream cheque is still too small to live on comfortably and a further thirty acres should be cleared but he cannot afford to borrow the cash required and is not sure that he could secure the labour even if the capital were to be found. Will require a new bull within six months time.

12. Mr. G. Norris. One of the best farms on the scheme with a comfortable home, good pastures and a fair herd of cows. Milking 52 cows and buying additional young heifers from Mr. Harness. Expects to plant four acres of maize for winter food. Anticipates an increased production of butter fat.

13. Mrs. Bussell. This is not a scheme farm but is one that has supplied the factory from the beginning. It is being managed by Mrs. Bussell and her mother, Mrs. Maitland-Woods, and for two ladies the task is a difficult one. Only part of the farm is in use and the modest cream cheque has declined somewhat in the last three years. The bails have been rebuilt lately and are in excellent order.

14. Mr. Brake. An experienced dairy farmer from New Zealand who took up a farm in August, 1927. Has made excellent progress in clearing land and planting to Paspalum. Milking 18 cows and has sufficient pasture for more. Is now handicapped for lack of capital.

15. Mr. Kellar. This farm has improved greatly in the last three years and will now carry more cows than are available. Milking 33 cows; a steady increase in production has been made in the last three years and Mr. Kellar expects to maintain this increase. Expects to plant three acres of maize to supply winter feed.

16. Mr. Sacks. A small supplier who has recently started dairying and who expects to become a regular supplier.

17. Mr. Gatward. At one time a banana planter on a large scale has now converted his extensive flat lands into dairy pastures and has become one of the largest individual suppliers to the factory. Now milking 62 cows and expects to be milking 80 by the end of the year. Expects to start a second farm of 40 cows on a share basis. Is planting considerable areas to Paspalum. Has sufficient land to develop a third farm.

18. Mr. Clifford. Has 45 acres in use, all free from weeds and growing sensitive plant. Is milking 22 cows and has feed for another 10 but his financial position is such that he is unable either to obtain more stock or to clear additional land and has difficulty in meeting the rent of £15 per annum. The family does all the work on the farm. Lack of finance is the chief difficulty.

19. The Fijian Melika has a most creditable dairy farm at Burerua. He was trained at Navuso and financed from provincial funds. Has twelve excellent cows, a pure-bred bull, good bails and a new cream separator. Started in July, 1928. No fences are required at present and the little pockets of Para grass in the neighbourhood of Burerua would support many times this number of cows.

20. Roberta and Turaga have another native dairy near Lodoni. I saw a few of the dry stock which were of good type but did not see the bails or milking herd. The amount of butter fat supplied has increased steadily since 1926 and the amount supplied in 1928 was 2,970 lb, worth about £190.

21. Mr. Compain. Took over Mr. J. L. Hunt's dairy farm near Lodoni and in 1928 rose to be the largest supplier of butter fat to the factory thus wresting the laurels from Mr. Gatward who held them for 1927. Mr. Compain was unfortunately absent when the inspection of his farm was made and I was unable to obtain particulars as to his anticipated increase in production. Mr. Compain is clearly doing well, however, and from what I saw of his lands and herd is likely to increase his production in 1929.

22. M. J. L. Hunt. Is now developing another dairy farm nearer Lodoni but no butter fat has yet been supplied to the factory.

23. Mrs. Hunt. Has been a small supplier but the supply is so small at present that she prefers to make Ghee for which there is a small local sale.

24. Mr. Milton Craig has improved his pastures very greatly in the last year and now has the making of a good dairy herd. Is now milking between 30 and 35 cows and hopes to be milking 40 by the end of 1929.

4.—SUBSTANTIAL PROGRESS MADE.

This review of the conditions obtaining on the farms of the suppliers shows that substantial progress has been made since the adoption of His Excellency's Message No. 5 of 1927. All but one of the vacant farms have been filled; pastures are being improved by the use of Paspalum, maize is being sown for winter feed, and an increase in production during 1929 and 1930 can be anticipated more especially by the outside suppliers.

5.—PRODUCTION OF BUTTER FAT, 1926-28 INCLUSIVE.

An important change is taking place at Tailevu in that the amount of butter fat supplied by the holders of farms under mortgage to the Government has declined while the production by outside suppliers has steadily increased.

	1926.		1927.		1928.
Scheme	51,356		49,062		43,720
Outside suppliers .	25,501		34,547		34,560
Total ..	76,857		83,609		78,280

The drought in 1928 brought about a decline in production that was unavoidable and the unoccupied scheme farms made matters worse.

With the scheme farms all occupied but one and with so much activity going on among the outside suppliers there are reasons for anticipating a production of 90,000 lb for the calendar year 1929 and it is anticipated that the outside suppliers will increase production more rapidly than the tenants of scheme farms.

6.—A PROFIT MADE ON THE FACTORY WORKING ACCOUNT.

From the beginning the factory has been operated as a unit and independently of the farms. At first it was unduly expensive to operate because the supplies of butter fat were so small. The Profit and Loss Account for 1926 showed a net loss of £908 0s. 11d., which was increased to £1,372 2s. 4d. by the end of 1927, which sum was written off as a final charge against revenue. With the production up to 80,000 lb of butter fat or one-third the capacity of the factory it was clear, however, that the factory could be made to pay its way by reducing the price for butter fat to an economic figure and on my recommendation this was done. This action marked the end of the "spoon feeding" period and the accounts now closed for 1928 disclose a profit of £426 12s. This is particularly satisfactory in view of the fact that the financial year was altered and that the period in question is one of nine months only, including the drought months when production fell off badly for lack of pasture.

7.—DISPOSAL OF THE PROFITS.

The Colonial Treasurer visited the scheme during the writer's absence in the Solomon Islands; he discussed the question of the payment of the then possible bonus with most of the suppliers who agreed with unimportant amendments to deposit half in a rest account to form the nucleus of a fund for floating the proposed Co-operative Company and to take the balance in cash. I found that this plan met with general favour and I was able without difficulty to obtain the consent of practically every supplier. In the case of those with very small cream cheques I did not urge the plan as it was obvious that the full amount due should be paid in cash.

8.—PLANS FOR FUTURE MANAGEMENT.

(a) Message No. 5 of 1927, stipulates that before the end of 1929 "every endeavour should be made to hand over control (by way of sale or otherwise) of the undertaking to the suppliers (both returned soldiers and others) on terms to be approved by this Council.

(b) When this final step is taken it will be necessary for the suppliers to assume financial responsibilities in respect to the factory which up to the present time has been lent by Government without any charge therefor.

(c) The conditions under which the Associated Banks of New Zealand assist in the formation of Dairy Companies are as follows, the information having been kindly supplied to me by the Manager of the Bank of New Zealand:—

- (1) *Paid up Capital.*—That at the outset the Shareholders provide in cash 25 per cent. of the estimated capital outlay on land, buildings, plant, and other fixed assets. That if the capital outlay exceeds the estimate or if extensions be carried out and further expenditure incurred on Capital Account, additional capital is to be provided in the same proportion to the new expenditure.
- (2) *Shares in other Companies.*—That, should the Company take up shares in any other Company, the Shareholders of the new Dairy Company be required to subscribe for a similar amount in shares of their own Company and to pay for these shares on the same terms as the Dairy Company is to pay for the shares in the other Company.
- (3) *Subscribed Capital.*—That Capital be subscribed to the extent of at least two-thirds of the amount of the advance asked from the Bank and that this proportion be maintained by the issue of further shares if the advance should be subsequently increased.
- (4) *Depreciation.*—That before the distribution of the year's surplus depreciation be written off all assets to the extent of at least the amount permitted by the Income Tax Department to ordinary companies doing similar business. This is at present 5 per cent. on plant and machinery, 2 per cent. on brick or stone buildings, and 3 per cent. on wooden or iron buildings. The amount so written off to be applied in permanent reduction of the overdraft limit.
- (5) *Annual Reductions.*—That so long as the Company is indebted to the Bank there be withheld from distribution to the suppliers at least 1d. per lb of butter fat supplied. This amount to be either applied in payment of the supplier's liability for Unpaid Capital, or written off the Company's assets (in addition to the amount mentioned in para. 4) or credited to a Reserve Fund or some internal account. Thus if one farthing per lb is held back monthly from the milk money and being credited to the Supplier's Share Accounts, three farthings per lb is to be held back before payment of a bonus and dealt with as mentioned in this paragraph.
- (6) *Security for Advances.*—That all advances be secured by Joint and Several Guarantees of suppliers, and by security over all assets of the Company, including uncalled capital.
- (7) *Re-arrangement of Capital—Extension of Operations.*—That in the case of existing Companies which are rearranging their capital, extending their operations or reconstructing, they are to be required to do so on a basis not less adequate than that laid down for new companies.

Note.—On 21st August, 1922, the Associated Banks agreed to refrain, in the meantime, from enforcing the repayments laid down in para. 5, provided the companies made reductions in the following basis:—

When the payment to suppliers for the whole season does not exceed 1s. per lb of butter fat	$\frac{1}{2}$ d. per lb.
When payment exceeds 1s. and does not exceed 1s. 9d. per lb of butter fat	$\frac{3}{4}$ d. per lb.
When it is in excess of 1s. 9d. per lb of butter fat	1d. per lb.

This arrangement applies only to factories engaged in the production of cheese and/or butter, and is to be reviewed from time to time.

Companies which put all their exchange business through their Bankers will be allowed best rates as regards exchange and interest on overdrafts, but those companies which do not put all their exchange business through their Bankers will be charged on their overdraft at least $\frac{1}{2}$ per cent. above the best interest rate.

"All their Exchange Business" means the negotiation of drafts in the Dominion against produce shipped, and, if such produce is shipped on consignment, the remittance of the resultant surpluses from London through the Companies' Bankers.

No Bank will take over a Dairy Company's account from another Bank because of dissatisfaction on the part of the Company arising solely out of these stipulations.

It was agreed that the transfer of no Dairy Company's account, debtor or creditor, shall be accepted by one Bank from another until the reasons for such transfer have been considered by the Associated Banks and the reasons for the proposed transfer of the account approved of as not being contrary to existing arrangements.

Surpluses in London.—All Dairy Companies are required to arrange that any surpluses accumulating in London be remitted out through their own Bankers, and that, as usual, all drafts drawn against shipments must be negotiated through the Companies' Bankers.

(d) As the factory and plant have been valued at £5,500, it would be necessary under clause 1 for the suppliers to find £1,350 in cash.

(e) Under clause 4 it would also be necessary to provide a sum estimated at £220 for annual depreciation of factory and plant that the suppliers do not now provide.

(f) It would also be necessary for the suppliers to pay the salary of a Business Manager who would be responsible to the Directors. Although the office would be a part-time one, it is doubtful whether anyone could be found to do the work for less than £250 per annum.

(g) When the Co-operative is formed, therefore, suppliers will have to find £1,350 in cash and £220 + £250 = £470 per annum that they do not now have to find.

VIEW OF THE SUPPLIERS.

(h) These matters were discussed individually with most of the suppliers during the week, and at a public meeting held in the School House on the evening of 9th February, the following suppliers were present: Messrs. Bannister, McMahon, Morris, N. W. Faddy, Blanch, Clifford, Kellar, Brake, Smith, H. S. Faddy, Cooper, Gatward, Harness, Mrs. Bussell and Melika,

The following resolution moved by Mr. Norman Faddy and seconded by Mr. Cooper was passed unanimously:—

“Resolved that Government be requested to continue control as at present for a further period of about two years or until the reserve fund has been built up to one-fourth of the capital value of the assets and that steps be then taken to form a co-operative concern.”

9.—RECOMMENDATIONS.

(1) The proposal contained in this resolution is a reasonable one that represents, I believe, the unanimous wish of suppliers and I recommend that it be approved. The scheme year closes on 30th September and the books are ready for audit about the middle of January. I interpret the above resolution to imply, therefore, that if the reserve fund now accumulating does not reach the total of £1,350 at a prior date Government should do everything in its power in February, 1931, to assist the formation of a Co-operative Company linked with a bank.

(2) In view of the substantial progress made, I recommend that the suppliers be held responsible as from 1st October, 1928, for any losses on factory working account made subsequently to that date and that conversely all profits on the factory working account made subsequently to that date shall be distributed to the suppliers *pro rata* as cash, all or part of which should if possible be deposited by the suppliers in a fund for the purchase of the factory.

(3) I recommend, further, that the factory and machinery be loaned as heretofore to the suppliers until such time as the Co-operative Company is formed—estimated to be in February, 1931, or at a prior date.

(4) The factory and assets have been valued at £5,500. I recommend that one of the Banks be invited to value these in February, 1930, so as to provide a definite basis for forming a Co-operative Company at a somewhat later date.

(5) Two years ago it would have been sound financially to close the factory at Korovou and to send cream to the Rewa factory. An important change has since occurred in the very large increase of butter fat coming from suppliers along the Lodon Road. In 1928, these suppliers sent 16,087 lb to the factory, the total supplied being 78,280 lb and, as these people would be debarred by distance from supplying the Rewa factory, it would no longer be sound financially to close the Korovou factory and I recommend accordingly.

LANTANA CROCEA.

By CHAS. R. TURBET, B.V.Sc., Senior Government Veterinary Officer.
THE name of the common *Lantana* plant in the vicinity of Suva has always been considered to be *Lantana camara* and, as such, was referred to in the feeding experiments carried out by the writer to determine the cause of Dermatitis of Cattle in Fiji.

Dr. Seddon, of the Veterinary Research Station at Glenfield, New South Wales, could not agree that *Lantana camara* possessed toxic properties. He stated, however, that *Lantana crocea* was, undoubtedly, very toxic.

This led to the following correspondence with Dr. Darnell Smith, Director of the Botanical Gardens, Sydney:—

Sir,

11th January, 1929.

For many years a plant of the genus *Lantana* has been very prevalent in Fiji. It has always been known here as *Lantana camara*. I now have reason to doubt this earlier

diagnosis however, and consider that the plant might be *Lantana crocea*, or that both *L. camara* and *L. crocea* exist here.

2. My opinion is based on the description of *Lantana crocea* given by F. Manson Baily in the "Queensland Flora," Part IV, page 1171.

3. The common plant here corresponds to that description in its manner of growth being shorter and more compact than some *Lantana* when growing in the open and not shaded. The flower colours also correspond to *L. crocea* although I have never seen a blue flower. The colours are: white, white with yellow centre, pink with yellow centre, red with yellow centre and red.

4. I have also definitely produced poisoning of cattle by feeding the local plant. At the time I had no doubt but that it was *L. camara*. Seddon, however, cannot agree that *L. camara* has poisonous properties. I would be much obliged then if you would give me your opinion as to whether the plant is *L. camara* or *L. crocea*.

5. I am forwarding pressed flowering shoots of the plant in the same mail.

Trusting that this request is not encroaching too much on your valuable time and thanking you.

I have, &c.,
C. R. TURBET.

And the following reply from Dr. Darnell Smith:—

The specimens forwarded for identification seem to belong to the species or sub-species *Lantana crocea*. It is extremely difficult to distinguish this from *L. camara* in the dry state. When the living plants are examined and the flowers are quite fresh there is no difficulty in separating the two forms. *L. crocea* seems to be identical with our garden forms labelled *L. camara* var. *Rougiere-chauviere*. They are not so tall and are more compact than the common *L. camara*, but, except for the colour of the flowers (easily detected when the flowers are fresh), there is scarcely any other character whereby they can be distinguished one from the other. The corolla of *L. crocea* is slightly longer than that of *L. camara*, but in the herbarium specimens even this character is hard to define.

G. P. DARNELL SMITH.
Director.

INTRODUCTION OF SPALANCIA CAMERONI, PARASITE OF THE HOUSEFLY, INTO FIJI.

THROUGH the courtesy of Mr. Fullaway of the Department of Agriculture, Hawaii, three consignments of housefly parasites have been received from that country. This material, when bred out, proved to be *Spalangia cameroni*, a species, which, in Hawaii, uses Hornfly puparia, in cow droppings, as a host.

These parasites are doing well in our Laboratory where they are breeding in both housefly and Sarcophagid puparia. Both of these live in cow droppings, the former generally leaving to pupate in the soil, the latter remaining, as a rule, within the dropping, which is also the habit of the Hornfly. Whether this difference in habits between the Fijian housefly and its Hawaiian host will seriously affect its efficiency, remains to be seen. It seems probable, however, that it will find difficulty in reaching a large percentage of the fly pupæ and that further predators and a larval parasite are desirable, if appreciable reduction in the numbers of this disease-carrying pest is to be obtained.

Liberation of the new introduction, now number over 6,000, the bulk of which have been released about Hills' dairy in Circular Road, but 500 were set free at the Golf Links, a further 400 four miles out on the Rewa Road, and 250 at Sawani.

HUBERT W. SIMMONDS,
Government Entomologist.

THE LIFE HISTORY OF TELEONEMIA LANTANAE.

By H. W. SIMMONDS, F.E.S., Government Entomologist.

INTRODUCTION.

THIS Tingid bug, which is a native of Mexico, was introduced into Hawaii by Koebele, in 1902, with the object of assisting in the control of the weed *Lantana camara*. In November of last year (1928) a strong colony of 10,000 was collected by the author in Oahu, Hawaii and, thence transported to Fiji. These are now being bred and liberated in this country, some details of which were reported in our last issue.

In the course of this work a number of facts concerning the life history of the bug have been worked out and these are now placed on record.

The life cycle is incomplete, in that we have no definite knowledge as to the period which elapses from when the insect mates until it commences to oviposit. Indications are, however, that it is very short.

There is a certain amount of variation in the time taken by the individuals in any one batch to reach maturity, which in the laboratory, showed a minimum of ten days. The egg stage was found to be fairly constant in summer weather at about seven days, so that from egg to adult can be completed in seventeen days, pairing can occur within twenty-four hours and it seems certain that from one generation to the next occupies less than four weeks probably only three. Thus it will be seen that under favourable circumstances, the insect should be capable of breeding up very rapidly. It has, however, in Fiji, met with certain powerful enemies, which are retarding its spread and these will be referred to more fully later on.

LIFE CYCLE.—OVIPOSITING.

The adult *Teleonemia* sucks the juices of the underside of the mid, or one of the major, veins of the lantana leaf, generally selecting one of the younger and more succulent pairs. This action causes a brown discolouration and corking of the affected portion, whilst the leaf curls inwards, often with considerable distortion.

The eggs are deposited singly and upright, within the wounded tissue, any number up to about 25 or 30 being placed in one mid-rib. I have occasionally observed eggs placed further along a vein, away from the wound, or on an unsucked leaf, but, on one occasion, this happened after the female had been disturbed, which is probably usually the case when this occurs. I also once observed an egg lying openly on the surface of a leaf.

Ovipositing in the few instances where it occurred in the laboratory took place at night. It has not been observed in the field, but probably this is normal.

THE EGG.

The egg is pale-yellowish and shaped much like a sparklet syphon cartidge, but somewhat flattened on one side. It is contracted at the top end, where the chorion is drawn out into a series of spine-like processes forming a collar round the operculum. Placed over this, and projecting above the rib of the leaf, is a nipple-like structure divided into two lobes, looking like a brownish-white pustule or the fruiting body of some fungus. [Imms, speaking of the Tingidæ, states: "The eggs are frequently inserted upright in the plant tissue, and are invested in a brown viscid substance, which hardens to form a cone-like elevation on the surface of the leaf." (Text-book of Entomology, Imms, page 348).]



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- 1.—Adult *Teleonemia lantanae*, Dist x 16.
- 2.—Nymph of *Teleonemia lantanae*, 4th instar x 20.
- 3.—Section of midrib of Lantana leaf, laid open to show eggs of *Teleonemia* "in situ" x 16.
- 4.—Egg of *Teleonemia lantanae*, Dist. greatly enlarged.(about 170 x).

Hubert W. Simmonds, del.

The total number of eggs laid by one female is unknown but several batches of nymphs, separated in age by a few days and feeding together, frequently accompanied by a still ovipositing adult, indicate that she deposits several batches at short intervals. The number of eggs in one batch averages somewhere between 20 and 30. The duration of the egg stage, in normal summer weather, averages seven days.

THE NYMPH.

The number of nymphal instars is still uncertain. In most cases only five have been observed, but in one specimen, bred in the laboratory, six occurred. When newly hatched the nymphs are very minute and it is easy for them to cast their skins which may escape observation.

The following life history was based upon the six instar specimen mentioned above. It was bred from an egg laid in the laboratory, taking twelve days, from egg to adult.

First Instar.—When first hatched the young nymph possesses an elongated, campodeiform type of body of a whitish colour, which, however, quickly contracts to the typical bug shape, whilst the colour becomes pale yellow, with darker patches of food showing through the abdomen as soon as feeding commences.

As a rule they settle down for this purpose within the shelter formed by the young curled leaf, but on older and less warped ones they make their way to the junction of two major veins, quickly causing it to become contorted at this point, whilst owing to the removal of the contained juices it shows whitish or pale-yellow on the upper surface. On the under surface the drops of brown excreta deposited by the nymph are particularly characteristic and give a speckled darkened appearance to the attacked portion.

The duration of this stage seems very variable, but was in this case between 24 and 36 hours.

Second Instar.—Very little difference could be observed between the second and first instar and in the case under review this stage only lasted 24 hours.

Third Instar.—This stage lasted 36 hours. There was a little, but noticeable increase in size and also some darkening.

Fourth Instar.—In this stage, which lasted 47 hours, slight traces of the wing buds could be observed, the colour also was darker.

Fifth Instar.—In this stage the wing buds become well developed, occupying one-quarter the abdominal length. In the specimen under review this instar lasted just under three days.

Sixth Instar.—In the final nymphal instar the wing buds extend to half the abdominal length. The nymphs are very dark in colour and often feed on the upper surface. In both this and the preceding instar they show a tendency to feed on older leaves than in their earlier stages. This instar lasted three days.

The following are the details of this specimen, which took twelve days from egg to adult:—

Egg laid night of 17th to 18th January, 1929.

Egg hatched 9 a.m. of 25th January, 1929.

First moult night of 26th to 27th January, 1929.

Second moult night of 27th to 28th January, 1929.

Third moult 10 a.m. of 29th January, 1929.

Fourth moult 9 a.m. of 31st January, 1929.

Fifth moult night of 2nd to 3rd February, 1929.

Adult 9 a.m. of 6th February, 1929.

Mated 9 a.m. of 7th February, 1929.

A second life cycle, based on a five nymphal instar specimen, which is probably the more normal, is as follows:—

Hatched night of 17th to 18th February, 1929.

First moult night of 18th to 19th February, 1929.

Second moult night of 20th to 21st February, 1929.

Third moult night of 22nd to 23rd February, 1929.

Fourth moult, 25th February, 1929, 9 a.m.

Adult, 1st March, 1929, 8.30 a.m.

Taking eleven days from hatching to adult, which is about the average.

There was a certain amount of variation in the time taken by various individuals to mature, but in the laboratory ten days was the minimum for the nymphal instars, with a further seven for the egg stage, making seventeen from egg to adult.

ADULT.

The newly emerged adult is, as in all the earlier stages, white when it leaves the cast skin of the last nymphal instar. After an hour or so it will be found to have gradually assumed its normal brown appearance.

Like the nymphs, the adults suck the juices of both leaves and young *lantana* stems.

Pairing takes place within a very short time of reaching the adult stage, having been observed in the case of a bred female and wild male twenty-four hours later. It frequently, but by no means always, appears to occur on the leaf upon which the female underwent her final metamorphosis. Whether the male is generally of the same colony or whether a flight is first essential I have not yet been able to ascertain. The adults fly freely with a rapid motion of the wings, and it was found that the first generation bred in the open quickly scattered over a circle of perhaps 100 yards in diameter.

The period which elapses from pairing to ovipositing is uncertain as I have been unable to induce bred females to deposit their eggs under observation and it is possible that flight is a necessary factor, although the heavy infestation of one bush, whilst an adjoining one remains free, seems to negative this.

NATURAL ENEMIES IN FIJI.

Teleonemia has undoubtedly found considerable difficulty in establishing itself in Fiji. Strong colonies of over 1,000 adults have disappeared, or in other cases are, after about three generations, only to be found in very small numbers. This may be in some cases partially due to scattering, but generally, it seems, to the presence of powerful natural enemies. This is indicated by the number of colonies which show the cast skins of the earlier instars and disappear without leaving those of the final stages. These enemies are predatory and, having destroyed their victim move on and are thus difficult to discover.

Spiders probably take a toll and I have found adults in their webs, also under some circumstances ants undoubtedly destroy a certain number.

The above are, however, apparently of very minor importance as compared to the *Lygaeid* *lantana* seed feeding bug, *Germalus pacificus*, which seems to have found in *Teleonemia* a very desirable food. The first observation was made on 10th January, when a nymph of *Germalus* was observed with its rostrum in the dead body of a *Teleonemia* nymph. The *Germalus* was caught, but it dropped its victim, so that it was not possible to examine the latter.

The captured *Germalus* nymph was placed in a jar with another *Teleonemia*. The attack was not observed in this case, but the *Teleonemia* nymph was found dead two hours later. The experiment was repeated and in several instances the attacks were observed. They were not always successful, the *Teleonemia* taking alarm at the first thrust of the *Germalus* nostrum. This thrust occurred in one case between the joints of the antennæ and in another, in the leg. In both these cases the *Teleonemia* escaped but seemed restless, as if poisoned, and did not settle down to feed again for twenty-four hours.

In one case observed the *Germalus* attacked a first or second instar *Teleonemia*, piercing its abdomen dorsally and then raising it into the air, held it there until life was extinct.

There is also little doubt that the *Germalus* sucks the *Teleonemia* eggs, the predator having on two occasions been observed with its rostrum into the egg mass, which when removed gave low percentages of hatching (about 50 per cent.).

There is thus little doubt that in *Germalus pacificus* the introduced *Teleonemia* has found a powerful enemy and in liberating colonies it has been found advisable to place them on small isolated bushes rather than on the big continuous areas. Whether they will breed up in sufficient numbers to offset the *Germalus* remains to be seen.

An unidentified *Capsid* has also been observed under circumstances which suggest that it is also predatory, but in any case this is a scarce insect and of little account as compared to the *Lygæid*.

PRESENT POSITION OF *Teleonemia* IN FIJI.

At the time of writing (April, 1929), the bug is well established on the Reclamation and at Circular Road in the Suva District, whilst a newer colony at three miles on the Tamavua Road is doing well. Other colonies have been liberated at Lami (three places), opposite the Asylum, Rewa Road (four miles), and Tamavua Road (two miles), also one at Sawani.

Strong colonies have been sent to Savusavu, Natewa Bay, and Taveuni. The present condition of these is, however, not yet known.

Note.—The species of *Lantana* common around Suva has recently been identified as *L. crocea* and not *L. camara*, as formerly supposed. See page 34 of this issue.—H.W.S.

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